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BEHAVIOUR MODIFICATION AND PERCEPTUAL-MOTOR PERFORMANCE

by

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A THESIS

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The undersigned certify that they have read, and recommend to The Faculty of Graduate Studies for acceptance, a thesis entitled Behaviour Modification and Perceptual-Motor Performance submitted by Ruth Horn in partial fulfilment of the requirements for the degree of Master of Arts.

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ABSTRACT

The purpose of the study was to determine whether the use of reinforcement principles can modify or shape the behaviour of children with learning disabilities so facilitating their perceptual-motor performance.

A subsidiary problem was to test the generalization effect of perceptual-motor training to body image development in children with learning disabilities.

All subjects were children having learning disabilities and were pupils of the Evelyn Unger School of Language and Learning Development. A six-week training program of perceptual-motor activities was given to an experimental group of four subjects. This experimental group and a control group, also of four subjects, were pre- and post-rated on the Purdue Perceptual Motor Survey (Roach and Kephart, 1966) as a measure of perceptual-motor efficiency; and on the Hand, Eye, Ear Test (Head, 1926) and the Personal Orientation Test (Weinstein, 1958) as measures of body image development.

Recordings of subject behaviour were made throughout the experimental training program. Frequencies of appropriate and inappropriate behaviours were recorded. A baseline pattern was obtained for each subject. Three training con-

ditions were given. In Condition I positive social reinforcement was given contingent upon appropriate behaviour. In Condition II positive social reinforcement was given contingent upon inappropriate behaviour. In the final training condition positive social reinforcement contingent upon appropriate response was reinstated.

Results on the Purdue Perceptual Motor Survey indicated significant improvement in perceptual-motor efficiency for the experimental group and no change for the control group over the training period.

The recordings of behavioural responses indicated that the response pattern of the experimental group closely followed the pattern of reinforcements.

Results for the experimental group on the Purdue Perceptual Motor Survey during the different training conditions indicated that the use of reinforcement to modify behaviour can facilitate perceptual-motor performance.

Significant gains were found over the training period for the experimental group on the two measures of body image development. No significant gains were found for the control group. This indicates that the acceleration of perceptual-motor development in children with learning disabilities leads to a concomitant gain in generalized body image development.

This study re-emphasized the importance of perceptual-motor development to the broader, total development of the child. It also suggested that systematic reinforcement techniques used in modifying behaviour may prove viable instruments in the acceleration of perceptual-motor development. It is further suggested that these techniques might be applicable to the child with learning disabilities in giving him a consistent learning environment. In particular the application of behaviour modification for the development of perceptual-motor performance in children with learning disabilities should be further considered, since perceptual-motor efficiency is often fundamental to further development.

It is recommended that research should investigate these relationships with larger groups of children with learning disabilities, and possibly with other aspects of motor-learning. Future studies might also determine the extent of the generalization effect of perceptual-motor training on other parameters.

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STATEMENT OF THE PROBLEM

INTRODUCTION

Recent research has given attention to the learning process in young children. Interest has focused particularly on children with learning disabilities. The possibilities of motor activity as a learning experience have stimulated a number of researchers to formulate perceptual motor programs (Barsch 1965; Delacato, 1959, 1963; Frostig and Horne 1964; Getman, Kane, Halgren and McKee 1966; Kephart 1960, 1965).

Newell C. Kephart (1960) suggests a hierarchy of learning tasks in which perceptual motor-skills form a basis for later learning. Painter (1966) utilised suggestions from Kephart as well as Barsch's Movegenic theory (1963) in a training program for children with learning disabilities. The program was run in a group setting within a regular public school kindergarten. Results suggested the efficacy of such a program in the amelioration of certain types of learning disability.

The child with learning disabilities may lack an

adequate background of learning experiences. He may be developmentally retarded compared to the norm for his age. Or he may suffer from some kind of dysfunction in the central nervous system. Frequently children with learning disability may be lacking in basic perceptual-motor efficiency. Also they can often be highly distractable. This may result in a characteristic pattern of behaviour which hinders the learning process.

Research has shown that behaviour modification is an effective technique of controlling attention with atypical children. The efficacy of behaviour modification with children having learning disabilities has been documented by Hewett (1965) and Lovitt (1968).

Research has tended to concentrate on the actual techniques of conditioning and the results in terms of behavioural changes. Only one study dealt with behaviour modification and motor activity. This was a study by Johnson et al. (1966) investigating the effects of positive social reinforcement on the rate of vigorous physical activity of a pre-school boy. Reinforcement techniques were used to increase the amount of time the boy actually spent in activity on a climbing frame.

The present study attempted to determine whether behaviour modification influenced the rate of perceptual-motor learning. Perceptual-motor learning was measured

in terms of performance on the Purdue Perceptual Motor Survey.

The underlying assumption of Kephart's methods is that perceptual-motor efficiency will generalize to other learning situations. Ball and Edgar (1966) tested and to some extent verified this premise. Their research with normal kindergarten children investigated the relationship between a training program based on the activities devised by Kephart, and one aspect of the concept of body image. The present study investigated this relationship in children with learning disabilities.

PROBLEM

The present research investigated the effect of behaviour modification upon perceptual-motor performance. The following hypotheses were suggested:

1. A perceptual-motor training program based on the work of Kephart (1960) will result in improved perceptual-motor performance in children with learning disabilities.

2. Changing the pattern of reinforcements will change the behavioural responses of subjects with learning disabilities. Reinforced behaviours will increase and non-reinforced behaviours will decrease.

3. (a) Permitting inappropriate behaviours inhibits perceptual-motor performance in children with learning disabilities. Encouraging appropriate behaviour facilitates perceptual-motor performance.

   (b) Use of reinforcement techniques to increase the occurrence of appropriate behaviour can accelerate perceptual-motor learning.

SUB-PROBLEM

There is a basic assumption underlying Kephart's work. The assumption is that improvements in perceptual-motor efficiency will generalize to other situations. This was verified by Ball and Edgar (1966) with regard to one aspect of the concept of body image. Their subjects were normal kindergarten children. Maloney (1970) demonstrated this generalized effect of perceptual-motor training for mentally retarded subjects.

The present study tested the generalizability of perceptual-motor training in children with learning disabilities. The criterion used was one aspect of body image development. The following hypothesis was suggested:

4. When perceptual-motor development is accelerated in children with learning disabilities there is a concomitant generalized effect to body image development.

JUSTIFICATION

It is accepted from the literature that social reinforcement applied systematically is an effective means of modifying behaviour. Reinforcement principles offer a clear, objective guide for precisely discriminating occasions for giving and for witholding adult attention. Such attention is a strong positive reinforcer for most young children. This study tried to determine whether those principles can modify or shape behaviour so that perceptual-motor performance is facilitated.

Underlying the work of Kephart is the assumption that the perceptual-motor training procedures used will have more than a specific effect. Improvements in the training program will generalize to wider, non-training types of situation. It is suggested that practice in perceptual-motor skills will enable a child to participate with greater success in more formal learning activities.

This assumption has been tested to some extent by Ball and Edgar (1966) indicating that when perceptual-motor development is accelerated in normal subjects, there is a concomitant generalized effect to body image development. Maloney (1970) also found this concomitant generalized effect to body image when he gave retarded subjects a perceptual-motor training program based on Kephart's work.

Since Kephart's program was oriented primarily towards the slow learner, it is logical to test the effectiveness of perceptual-motor training in promoting this generalized effect to body image development in children with learning disabilities.

LIMITATIONS AND DELIMITATIONS

LIMITATIONS

The study was limited by the following:

1. The validity of the training program as a means of improving perceptual-motor efficiency. The types of activity were formulated on the basis of the work done by Kephart (1960) and Chaney & Kephart (1968).

2. The validity of ratings on the Purdue Perceptual Motor Survey as performance measures of perceptual-motor learning. The Survey is primarily disgnostic in nature, but gaining a higher rating after training should be indicative of improved perceptual-motor efficiency.

3. The consistency and accuracy of the investigator to give systematic positive reinforcement and to record behavioural response patterns.

4. The novelty of the situation for the subjects during baseline recordings. This may have intrinsically motivated them so that they achieved a high level of performance.

Later in the study the novelty and the motivation it caused may have disappeared. Subjects would not be achieving their maximum performance.

DELIMITATIONS

The following delimitations were placed on the study:

1. Only eight subjects were selected due to their availability and the numbers which could be handled by the investigator.

2. The length of the experimental training program was designated as six school weeks. This gave only thirty training sessions for each subject.

3. A criterion was set for changing subjects from reinforcement of appropriate behaviours (Condition I) to reinforcement of inappropriate behaviours (Condition II). The criterion established was 80% or more appropriate responses in each of two consecutive training sessions.

4. A criterion was set for changing subjects from reinforcement of inappropriate behaviours (Condition II) to reinstatement of reinforcement of appropriate behaviours (Condition III). The criterion established was that the behavioural pattern at the end of Condition II should show a reversal of the pattern seen under Condition I.

5. Reinstatement of reinforcement for appropriate behaviours (Condition III) was continued until the behavioural pattern reflected that seen under Condition I. This marked the end of the training period.

6. Body image was the parameter examined for the generalized effects of perceptual-motor training. The criterion measures of body image were the Hand, Eye, Ear Test (Head 1926) and the Personal Orientation Test (Weinstein 1958).

DEFINITION OF TERMS

1. Learning disability: a condition where children, though not mentally retarded, have difficulty in learning. They are handicapped either by slow development, lack of adequate environmental experience, or some dysfunction of the central nervous system.

2. Perceptual-motor performance: performance is the observable behaviour of an individual. It is a measure of his level of learning at the time. Hence perceptual-motor performance is an indicator of the level of perceptual-motor learning in an individual.

3. Behavioural modification: this is the use of reinforcement procedures to change or shape behaviour. Reinforcement given for a particular aspect of behaviour results in an increase in that aspect. Other behaviours

correspondingly decrease.

4. Reinforcement: a reinforcer is a stimulus event which, if it occurs in the proper temporal relation with a response, tends to maintain or increase the strength of a response (Deese & Hulse 1967). In this study the reinforcer was positive social praise. Either appropriate or inappropriate responses were reinforced, depending on the training condition.

5. Body image: the ability to indicate either eye or ear cross-laterally and unilaterally, and the ability to indicate points on the front and back aspects of the body.

CHAPTER II

REVIEW OF THE LITERATURE

INTRODUCTION

The review of literature is organized into three major parts, with a summary of salient points. The first part considers the learning process. Particular attention is given to perceptual-motor learning.

A review of the literature concerning behaviour modification follows. The major theories from which behaviour modification and reinforcement procedures derive are discussed. Several research studies using such techniques are then reviewed. Finally attention is given to aspects of recording behavioural patterns.

The third part of the review discusses learning disabilities. The typical characteristics and learning problems of children with learning disabilities are listed. Mention is made of the behaviour disorders which usually accompany impairment. Lastly the possible effects on other mental processes are considered.

The summary links the different parts of the review

in relation to the problems researched in this study.

PERCEPTUAL-MOTOR LEARNING

Performance is the observable behaviour of an individual. It is an expression of his level of learning. Learning is a process of the central nervous system. It occurs when there is a change in response as a result of conditions in the environment. The learning process is continuous and involves a relatively permanent change in the central nervous system. It does not include changes in response due to maturation or fatigue.

Disabilities in the learning process may arise for an individual when conditions within the environment are inadequate. Slow development in terms of age 'norms' may also cause learning disabilities. Another reason may be some form of impairment in the functioning of the central nervous system.

Various authors have depicted the learning process as a series of stages. Piaget is one of the most important theorists holding this viewpoint. He sees individual development as a continual process of adaptation where perceptual inputs are assimilated and the central mechanisms accomodate to new experiences. Piaget (1953) breaks total intellectual development into units called periods, sub-periods and stages. Each of these units of development

ment is described in terms of the best the child can do at the time. Each includes many previously learned behaviours.

The three main periods of development are the sensorimotor period, the concrete operations period, and the formal operations period. Within each of these are subperiods and stages. It should be emphasized that each unit or division is not an adequate entity. Rather all are linked in the total developmental process in a progressive sequence.

Piaget lays much importance on this sequential nature of development. Each successive stage incorporates those that went before it. In particular Piaget emphasized the importance of basic sensorimotor experience as the forerunner of success in later abstract learning. The need for strong perceptual-motor foundations is illustrated in his examples of concrete operations preceding formal or abstract thinking.

These ideas of sequential stages of learning and the importance of basic perceptual-motor experience also pervade the work of Newell C. Kephart (1960, 1965). He feels that children must have a firm grasp of basic perceptual-motor skills before they can progress in more formal learning activities. Difficulties in learning and reading are often exaggerated by inadequate experience and ability in basic motor skills. Certain 'readiness skills'

are looked for in the pre-school child. These are generally thought to be acquired through maturation or the result of innate responses. Often the child who, on entering school, is not quite on a par with his peers will be given additional practice in these readiness skills in the hope that his achievement will improve.

Kephart feels this is tackling the problem too late. He suggests that educators should go further back than the readiness skills, because these may be complex and difficult for a child with an inadequate environmental background, organismic damage or emotional disturbances. Rather the readiness skills themselves should be broken down into more basic skills and practice given in these so that a firm ground is established on which to build later learning.

Kephart (1960, 1965) attempts to identify those basic learned skills. He suggests methods by which deficiencies in these skills can be detected, and gives training procedures which will attack the basic skills more directly. These detection procedures are given fully in the work of Roach and Kephart (1966).

Kephart supports the view that there is a link between basic perceptual-motor integrative phenomena and later perceptual and cognitive learning. Other researchers concur with this statement, both in the United States (Held,

1965) and in Russia (Zaporozhets, 1965). Where a child lacks an internal awareness of sidedness, for example, he may have excessive reading reversals, confusing b and d or p and q. This suggests the necessary link in the learning process is incomplete. Thus there is no appreciation of the orientational differences in symbols on a printed page. Kephart has outlined a training program to deal with these deficiencies which begins at the perceptual-motor level. The theory of perceptual development and the correlated training program formulated by Kephart involve more than one level of perceptual functioning, but it is the perceptual-motor training section which is of concern in this study.

Painter (1966) used certain suggestions from Kephart's theory in a study of the effects of a rhythmic and sensory motor activity program on the perceptual-motor spatial abilities of kindergarten children. The suggestions utilised were:

a) the generalization of rhythmic patterns.

b) the sequencing of unilateral, bilateral and cross-lateral movement.

c) the changing of unco-ordinated or jerky movements to large sweeping movements using the entire musculature of the body.

Subjects were the 20 lowest functioning children in a normal kindergarten class. The program was carefully

sequenced and included constructs from Barsch's Movegenics Theory (1965) as well as the suggestions from Kephart. Results showed that the program did bring about significant gains in body image, perceptual-motor integration, and psycho-linguistic competence. Painter suggests that such a program might be used in the amelioration of certain types of learning disabilities.

One of the main assumptions underlying Kephart's theory is that the perceptual-motor program he proposes will have more than a highly specific effect. Improvement achieved under the training situations will generalize to wider, non-training types of situation.

Ball and Edgar (1966) conducted a study designed as a critical test of this assumption. Their purpose was to determine whether Kephart's training procedures do in fact yield anything more than highly specific perceptual-motor skills. To discover this required a demonstration that perceptual-motor training generalizes to non-practiced performances, in this case relevant to body image. An earlier pilot study (Ball and Edgar, 1963) with retardates as subjects led the authors to expect positive results. The 1966 study used 30 children enrolled in regular kindergarten classes in a public school. All were in good health and free of perceptual defects. Fourteen comprised the training group and sixteen the control group. The subjects

were tested before and after the training program by an examiner unfamiliar with the subjects' training or control group status. The tests used were Benton's Finger Localization Test (1955), and a modified version of the Hand, Eye, Ear Test (Head 1926).

Training procedures were specifically designed to develop laterality and body image according to Kephart (1960). Care was taken to avoid any procedures directly related to the criterion measures. The difficulty of each activity was specifically geared to the child's needs. The activities used were walking board, balance board, chalk board (directionality and orientation), angels-in-the-snow, skipping, rhythm, rope jumping, peas-porridge-hot, stunts and games, and trampoline routines on bed springs and mattress.

The same assistants who worked with the training group spent time with the control group, but during regular classroom sessions. They related to the children through the activity in progress, talking with them about their drawings, constructions and stories. The prediction was that at the end of the training period, the training group would achieve greater gains on the criterion measures than would the control group. The results supported the claim that generalization occurs from specific perceptual-motor training.

The Ball and Edgar study (1966) indicated that when perceptual-motor development is accelerated in normal subjects, there is a concomitant generalized effect to body image development. Maloney et al. (1970) also found this to be true for retarded subjects.

Subjects in the study by Maloney et al. (1970) were 59 moderately and severely retarded institutionalized males. There were three groups, the sensorimotor training group; the attention-comparison group; and the traditional no-treatment control group. The sensorimotor training group was given a training program following the systematic procedures presented by Kephart (1960). The attention-comparison group engaged in sedentary activities involving equivalent amounts of inter-personal interaction with the experimenters as compared with the sensorimotor training group. The no-treatment control group was pre- and post-tested with a 2-month interval between tests.

The instruments administered as pre- and post-test measures were the Hand, Eye and Ear Test (Head, 1926); the Personal Orientation Test (Weinstein, 1958); the Finger Localization Test (Benton, 1959); and the Purdue Perceptual Motor Survey (Roach and Kephart, 1966).

The results obtained led to a number of conclusions. Firstly the data indicated that Kephart's sensorimotor training system does promote a generalized effect to body

image development. The findings failed to support the hypothesis that generalization from sensorimotor training would occur in finger localization after a period of specific finger training. Lastly the data indicated that 'attention-reinforcement' procedures generalize to certain non-practiced abilities which appear to have no relationship to the procedures used. This was attributed to an increase in an attention-motivation factor which serves to heighten general test-taking ability (Maloney, 1970).

Thus research has shown that training programs based on Kephart's models will give a generalized effect to body image development. This has been demonstrated with normal kindergarten children (Ball and Edgar, 1966), and with retardates (Maloney et al. 1970). No evidence was found of this hypothesis having been tested with children who have learning disabilities but who are of average or near-average intelligence.

BEHAVIOUR MODIFICATION

The theoretical background of operant conditioning results in the applied practice of behaviour modification using reinforcement techniques. The main theorists in this are Thorndike and Skinner.

The conclusions in Thorndike's work (1913) of partcular interest are termed under "Law of Effect". This law

refers to the strengthening or weakening of a connection as a result of its consequences. When a modifiable connection is made and is accompanied by or followed by a satisfying state of affairs, the strength of the connection is increased. If the connection is made and followed by an annoying state of affairs, its strength is decreased. (Hilgard and Bower, 1966).

Thorndike (1913) states his meaning of satisfaction and annoyance in operational terms:-

> By a satisfying state of affairs is meant one in which the animal does nothing to avoid, often doing things which maintain or renew it. By an annoying state of affairs is meant one which the animal does nothing to preserve, often doing things which put an end to it.

In more familiar terms Thorndike is saying that rewards or successes further the learning of the rewarded behaviour, whereas punishments or failures reduce the tendancy to behaviour which leads to punishment or failure.

Skinner in his 'Behaviour of organisms' (1938) brought together his experiments and theories. These theories were a development along the lines of Thorndike's learning by selecting and connecting under the law of effect. Skinner acknowledges two kinds of learning but places more emphasis upon that kind of learning which is under the control of its consequences. The system of behaviourism using conditioning principles can be under-

stood in these terms.

Essentially Skinner distinguishes two types of response, respondants and operants. Respondants are elicited by known stimuli, for instance the knee jerk response to the patella tap. Operants are emitted with the stimuli, if any, being irrelevant. (Skinner refers also to a particular type of operant, a discriminated operant. This has a relation to some prior stimulus but not to the preceding stimulus.) Since the stimulus in operant responses is irrelevant, this type of behaviour cannot be measured as a function of stimulation. Instead the rate of responding is used as a measure of the operant strength.

Along with these two types of responses, Skinner differentiates between two types of conditioning. Conditioning itself refers to the act of changing behaviour by the use of reinforcement. In respondant conditioning reinforcement is correlated to the stimulus. This type of conditioning is the classical conditioning associated chiefly with Pavlov. In operant conditioning reinforcement is correlated with response, and is contingent upon response. Skinner (1938, 21) states that: "If the occurrence of an operant is followed by presentation of a reinforcing stimulus, the strength (of occurrence) is increased."

This statement can be compared to Thorndike's Law

of Effect. According to Skinner what is strengthened is not a stimulus-response connection because the operant requires no stimulus. Skinner (1938, 22) continues:

> This dependence upon the posterior reinforcing stimulus gives the term operant its significance .... The operant... becomes significant for behaviour and takes on an identifiable form when it acts upon the environment in such a way that a reinforcing stimulus is produced.

To distinguish this type of conditioning from classical conditioning Hilgard and Marquis (1940) have called it instrumental conditioning. In this study any references made will use Skinner's original term of operant conditioning.

Ferster and Skinner (1957) identify as many as sixteen classes of reinforcement schedule in the process of operant conditioning. There are many more variations. The four main classes are:

a) fixed-interval --- reinforcers are dispensed every so many seconds.

b) fixed-ratio --- reinforcers are dispensed every so many trials.

c) variable-interval --- reinforcers dispensed on average once every so many seconds following a correct trial.

d) variable-ratio --- reinforcers dispensed on average

every so many correct trials. The subject never knows which correct response will be reinforced. This produces a rapid, increasing rate of responding (So-called Gambler's Syndrome).

Each schedule produces its own particular type of response-curve. The variable-interval schedules produce a consistently high, steady rate of responding, and are highly resistant to extinction. Extinction refers to the removal of reinforcement from the behavioural situation. Measurement can be made on the rate of responding or the total number of responses.

The superiority of the variable-interval schedule with regard to resistance to extinction was shown in a study by Bijou (1957). He conducted two experiments involving operant conditioning techniques with 39 pre-school children. Reinforcement was in the form of small trinkets. Intermittent training patterns consisting of reinforcements on 20% of the correct responses were employed in both investigations. Results agreed with studies using subhuman subjects in that the intermittent schedule showed more resistance to extinction than the continuous reinforcement.

A word should be said about the actual types of reinforcers. Primary reinforcers are based on physio-

logical needs such as food and water. Secondary reinforcers can be any stimulus associated with a primary stimulus. "A stimulus that is not originally a reinforcing one -- can become reinforcing through repeated association with one that is." (Keller and Schoenfeld, 1950 p. 232).

A further consequence of the development of secondary reinforcement is the emergence of a class of generalized reinforcers (Skinner, 1953). This refers to instances of secondary reinforcers accompanying a variety of primary reinforcers. Such generalized reinforcers would satiate the so-called needs for attention, affection or approval. Skinner says that such generalized reinforcers are eventually effective without the primary reinforcers upon which they are based.

One further concept of Skinner's is of relevance, that is the concept of shaping a response. Unlike Thorndike for whom there were only correct and incorrect responses, Skinner believed that differentiation of a response could be achieved by the reinforcement of successive approximations of the desired response.

These theoretical concepts of Skinner and other psychologists have been employed by a number of investigators in behaviour modification studies. One such study (Hart et al. 1964) investigated the effects of social reinforcement on operant crying. The subjects were two

pre-school boys who showed a high frequency of operant crying, that is crying which is emitted and/or maintained depending upon its effects on the social environment. Teachers systematically applied reinforcement procedures. They gave no attention to outcries unless the child was actually hurt, and gave approving attention to every more appropriate response to mildly distressful situations. Within a week operant crying had practically disappeared in each case.

Reversal of procedures reinstated operant crying responses in subject 1. Return to original procedures quickly reduced operant crying to a very low level which was maintained during the rest of the year. With subject 2 reversal of procedures raised the level of operant crying for a few days, then suddenly the crying dropped out and remained at almost zero for several more days. All procedures were stopped, since this sudden disappearance of the behaviour was completely unexpected. Upon investigation it appeared that the reason lay in the crying responses being no longer necessary. The subject received teacher-attention if he looked as though he were about to cry. Hence he had no need to actually cry. A short while later, however, operant crying did reappear and the original procedures were again applied. Operant crying quickly dropped out and remained negligible for the rest of the school year. It was noted that after systematic

extinction procedures were reinstated, subject 2's operant crying behaviour extinguished much more gradually than that of subject 1. A possible reason was that subject 2's reinforcement schedule had been intermittent, while subject 1's had been continuous. This is contiguous with the literature (Ferster and Skinner, 1957) which demonstrates that extinction after a continuous schedule of reinforcement is more rapid than after an intermittent schedule.

Allen et al. (1964) looked at the effects of social reinforcement on isolate behaviour of a nursery school child. The subject was a pre-school girl who exhibited a low rate of interaction with her peers. The study aimed to help her achieve sustained play relations through the systematic use of behaviour modification principles. Teacher attention was designated the positive reinforcement. Attention was given consequent upon interaction with another child, and withheld consequent upon solitary play or attempted interaction solely with an adult. Interaction with other children rose markedly over six days following the five days of baseline recordings. One to one interactions with adults decreased. Reversal of procedures depressed child-child interaction and increased interaction solely with adults. Reinstatement of original procedures restored peer interaction. As social behaviour with peers became firmly established, reinforcement under both contingencies was presented on an increasingly intermittent

schedule. Later checks indicated that adequate social play behaviour was maintained through the rest of the school year.

Positive social reinforcement was the conditioning agent in a study by Harris et al. (1964) on regressed crawling of a nursery school child. The purpose was to use social reinforcement procedures in a nursery school situation to help a child substitute already established walking behaviour for recently acquired crawling behaviour. Adult attention was systematically given as an immediate consequence of one behaviour and withheld as an immediate consequence of the other behaviour. Results of the study indicated that:

a) adult attention had powerful reinforcement values.
b) reversal of reinforcement procedures had distinct effects.
c) systematic use of reinforcement principles brought about rapid positive changes in behaviour seeming to facilitate both child learning and adult teaching.

Reinforcement principles were used in the development of motor skills in a young child by Johnston et al. (1966). The subject was a pre-school boy who showed an unusually low rate of vigorous physical activity. This was changed to a normal rate through systematic social

reinforcement of climbing behaviour on a specific piece of play-yard equipment. Initially a high rate of climbing behaviour was developed by a teacher giving her attention contingent upon the child's contact with the piece of equipment and withholding her attention for other behaviours as far as possible. A reversal of these contingencies reduced the climbing behaviour and later, reinstated again, produced a high climbing rate. Climbing behaviour was then generalized to other playground equipment by reinforcing the subject's use of this equipment.

Older children of the junior high age group were the subjects of a study by Broden et al. (1970). This study looked at the effects of teacher attention and a token reinforcement system in a special education class. These two conditioning agents were used to bring about control in a disruptive classroom situation. Baseline recordings of individual and group study levels were taken. Subsequent experimental periods employing teacher attention and/or a token points system increased study levels and decreased disruptive behaviours of class members. Reinforcement of appropriate behaviours was withdrawn during a short reversal period, producing lowered study rates. Reinstatement of reinforcement contingencies again resulted in increased study levels. The classroom teacher in this case was a first-year teacher without prior experience of teaching or of operant conditioning techniques.

Hewitt (1965) proposed a hierarchy of educational tasks for children with learning disorders. The establishment of meaningful contact between teacher and child is based on the behaviour exhibited by the child. The teacher achieves progress to the next level by modifying and shaping behavioural responses. The student experiences gratification and the teacher is in control.

Lovitt looks at the basic principles of behaviour modification and their immediate application. He concluded that such techniques can be put into practice in the public school. Behaviour modification provides the special educator with powerful tools to maintain or modify the behaviours of exceptional children.

In any study involving behaviour modification there are certain essential steps to follow, based on the principles of operant conditioning. Firstly the desired response must be potentially available and must be defined and delimited in terms of exactly what behaviour is expected from an individual. Next current behavioural recordings should be made in specific terms and analyzed. From this analysis, a series of logical steps can be set up to progress towards the desired behaviour, each step minimizing the chances of failure. This is based on Skinner's principle of 'shaping', or the reinforcing of successive approximations. Immediate reinforcement should then be given for desired behaviours,

at first on a continuous schedule and later on an intermittent basis (Baumeister, 1967).

MacMillan and Forness (1970) discuss some of the limitations and liabilities inherent in the behaviour modification paradigm. They examine some of the common misuses of the strategy. In their research they point out that the behaviouristic explanation of learning often over-simplifies the human situation. Some pure behaviourists view motivation as extrinsic to learning and commonly separate the reward from the behaviour. MacMillan and Forness believe that the separation may be justifiable in the early stages of a shaping program, but they contend that desired behaviour must come under the control of natural reinforcers as soon as possible. They emphasize that behaviour modification techniques must take into account the educational goals to which the shaped behaviour is related.

From the behaviouristic point of view motivation is seen as extrinsic to learning (Bijou and Baer, 1961). MacMillan and Forness note that the behaviouristic paradigm is unable to explain adequately the behaviours described by Piaget (1953), Festinger (1957), Harlow (1949, 1953) and White (1965). In these theories exploration, cognitive dissonance, curiosity and competence intrinsically motivate behaviour. The consequences of behavioural patterns so

motivated cannot be observed by recording. Such sources of motivation are important in teaching the atypical child.

The use of arbitrary of intrinsic reinforcers, if continued indefinitely, may fail to bring the child's behaviour under the control of reinforcers that will exist in his natural environment. MacMillan and Forness cite social praise as an example of a natural reinforcer.

The study concludes that behaviour modification strategy has tremendous potential for work with atypical children. Its limitations are that it gives no direction in determining educational goals. It may not take account of intrinsic motivation. It may preclude children from learning how to learn.

Recording Behavioural Responses

Such recording must be systematic and objective as well as quick and efficient to use. To attain a high degree of objectivity and accuracy, Johnson and Harris (1965) suggest the following:

a) The behaviour to be observed must be explicitly defined and an exact topography of responses decided upon in advance.
b) Observations must be made on a regular schedule.
c) Observations must then be recorded according to a planned system.

d) Finally the observations must be analyzed in terms of their environment.

Depending on the situation a variety of methods can be used to quantify behaviour.

a) Tabulated recordings may be made of the number of times a specified behaviour occurs within a given time period. This gives a raw frequency count.
b) The number of responses per trial may be recorded.
c) The presence or absence of specified behaviour within discrete time intervals may be recorded. This gives a continuous frequency of the specified behaviour.
d) Behavioural occurrences may be timed and tabulated on a chart or check-list. This gives a measure of behaviour duration.

The studies discussed above used these methods, or modifications of them. For instance, the recordings of Broden et al. (1970) were based upon discrete time intervals. A different subject was observed every five seconds and each subject once every 65 seconds. This gave observation recordings on a consecutive rotation basis.

Discrete time intervals were used by Johnson et al. (1966) and Allen et al. (1964). Both had 10-second time intervals. Harris et al. (1964) used the raw frequency count. This gave the number of instances of operant crying during each session.

LEARNING DISABILITIES

At every moment the individual is surrounded by an environment of physical energy to which his sense organs respond. His brain differentiates and structures; it makes sense out of directions so that it can direct his actions. A very young child learns that an object which looks round will feel round, and that one which looks pointed will feel sharp, and that certain sounds have meanings. In school, the child must make sense out of many symbols; chalk marks on the board, letters in his book, numbers on a paper. He must be able to produce them himself. It is no longer enough that he hear and understand speech, he must detect the slightest differences between words which sound alike but mean very different things. He must be able to listen attentively to explanations and instructions and, as rapidly as the teacher speaks them, relate them to action or experience so that they become integrated with what he already knows in order to extend the fabric of his knowledge and understanding.

The child with learning disabilities has trouble forming these refined and organised perceptions. He may misperceive. He may overlook important details or focus on them so strongly that he misses the whole itself. He may hear meanings but fail to attend to word structure; or he may mishear word structures and so be misled in their mean-

ings. Often sights, sounds and ideas may distract him from the task he is engaged in. He may seem compelled to continual motion and exploration or he may sit passive and withdrawn.

Such features are often the characteristics of the child with learning disabilities. In one way or another such a child is prevented from acquiring language and learning in the 'normal' manner or at the 'normal' rate. To say that a child has learning disabilities frequently means that he may be of normal intelligence, but his central nervous system does not receive, organize, store or transmit information in quite the same way as does that of a normal child. Such a child may show a wide gap between his ability to understand events, experiences and ideas, and his ability to learn to read, spell, write and compute numerically.

Language and learning disabilities can be manifest in many different ways. It may be that the child has problems in matching his actions to his perceptions. Or in other instances a child may not have the vocabulary of motor skill to achieve a perceptual-motor match. Lack of vocabulary or experience may also mean that the child perceives but is unable to interpret that perception. In Piaget's terms he has no basic structure into which the new information can be assimilated.

Some children show learning disabilities when alongside their peer group on the basis of age. Yet these children

may perform perfectly adequately when asked to function at a lower level of achievement. It seems that their problems may arise through emotional pressure when they are expected to function at a level beyond their capabilities. Such children may not suffer from any impairment but rather be slow in their development.

Another section of children suffer from learning disabilities because of actual impairment in the functioning of the central nervous system. Myklebust (1956) distinguishes between four types of symbolic language disorder due to such impairment.

In aphasia the impaired functioning of the central nervous system affects comprehension or expression of the spoken word. Receptive aphasia denotes an inability to understand the spoken word, even though it is heard. The expressive aphasic hears and understands but is unable to express himself verbally. The organs of speech are not damaged, the difficulty lies in putting thoughts into words. Aphasia usually becomes apparent in a child between the ages of two and four.

Dyslexia signifies the inability to interpret. The input of information from the written word cannot be related to past experiences. Thus it is a form of reading disability and is not usually apparent in children until they are between seven and eight years of age.

Impairment of the functioning of the central nervous system may also result in dysgraphia. This is an inability to relate the written word to the motor system in order to execute the act of writing. Dysgraphia is not apparent in the child until after he has learned to read.

Disorders of the central nervous system may impair the ability to acquire or use numbers. The child then has a symbolic disorder in arithmetic which is referred to as dyscalculia.

Language disabilities may also result from central nervous impairment affecting non-verbal behaviour. A child unable to distinguish between sights and sounds suffers from visual or auditory agnosia. Apraxia is an inability to relate experience to total motor systems. Receptive aphasia and dyslexia may be considered as forms of agnosia, while expressive aphasia and dysgraphia are forms of apraxia.

Myklebust also indicates that learning disabilities can result from malfunctions of the peripheral nervous system and from emotional disturbances. Deficiencies in the peripheral nervous system which affect language development are degrees of deafness and blindness. It is increasingly recognized that lack of language development may occur on a psychological basis. Emotional disturbances, severe pressure from parents and teachers, can result in difficulties or even a halt in the learning process.

The exact causes of learning disabilities are not known precisely enough for them always to be determined. Some have been suggested; for example, lack of environmental experience and retardation in the development of the higher centres of the brain. Where there is actual impairment of the central nervous system the cause may be injury to the tissues during birth, poor pre-natal care, oxygen deprivation at birth, illness of the mother. Chemical or blood irregularities can also affect the functioning of the central nervous system as can genetic inheritance and injuries to the foetus, traumatic falls or accidents, high fevers, and encephalitis.

Learning disabilities often affect the child of average or better-than-average intelligence, and occur more frequently in boys than in girls. (A ratio of about two to one.) For one reason or another inputs into the central nervous system, transformations within it, or the output of action is disrupted. Comprehension, interpretation or action are prevented. The individual is not able to cope with the environment in which he lives. He has insufficient basis for behaviour.

If a child has learning disabilities he will often have behaviour disorders too. Often such a child becomes emotionally unstable, moods changing from one extreme to another with amazing swiftness. The ability to tolerate

frustrating situations may be lower than normal, and the child may respond with withdrawal or inappropriate behaviour to a situation he can no longer tolerate. The child with learning disabilities wants to know exactly what is expected of him at every moment. Given unstructured material he may become more confused than ever. This was something upon which Montessori based her work. The design of her materials controlled error; they either work or they do not work. This helps to bring order into the chaotic world in which some children with learning problems exist.

Motoric retardation is not necessarily contingent with learning disabilities, but often problems in learning can affect motor behaviour. Catching a ball can be a hard task for the child who has never experienced ball play, or who is functioning developmentally at a more infant age. The child with perception problems or an inability to relate perceptions to actions will also find catching difficult if not impossible.

Giving children with learning disabilities perceptual-motor training broadens their background of experience. It may also accelerate the development of other forms of learning. Where the central nervous system is impaired, perceptual-motor programs may help to lessen some of the learning problems associated with such impairment. In short, whatever the cause of learning disabilities, perceptual-motor training may

be of value in their amelioration, as Painter (1966) has suggested.

SUMMARY

Perceptual-motor performance programs such as those of Kephart (1960) and Barsch (1965) can improve perceptual motor development. The studies of Ball and Edgar (1963, 1966), Painter (1966) and Maloney (1970) illustrate this. Perceptual-motor learning is an early stage in the total development of the child (Piaget, 1953, Kephart, 1960, Hewitt, 1965). All learning incorporates the preceding stages of development. If one stage is incomplete or malfunctioning then difficulties arise in later learning situations (Kephart, 1960).

Research has shown that reinforcement techniques are valid procedures to use in modifying the behavioural patterns of atypical children. Hewett (1965) and Lovitt (1968) discussed their use with children having learning disabilities. Johnson et al. (1966) showed that behaviour modification can assist in the development of a motor skill. In this case the procedures were used to develop climbing behaviour.

It is possible that the techniques of behavioural modification may be successful in assisting the development of a child's perceptual-motor structure. These techniques

may be particularly relevant to exceptional children lacking in perceptual-motor learning. If behaviour modification can accelerate perceptual-motor learning, it may also assist in the development of concepts generalized from that learning.

There is a basic assumption behind all perceptual-motor programs. Such programs assume a link between basic perceptual-motor integrative phenomena and later perceptual and cognitive learning (Held, 1965, Zaporozhets, 1965). The studies by Ball and Edgar (1963, 1965) and Maloney (1970) verified this assumption for normal kindergarten children and retarded subjects respectively. These studies used Kephart's perceptual-motor program. The test of generalizability was the development of one aspect of body image.

CHAPTER III

METHODS AND PROCEDURES

INTRODUCTION

The study was designed to study the effect of a perceptual-motor training program of a group of children having learning disabilities. The aim was to improve their level of perceptual-motor performance as shown by a rating on the Purdue Perceptual Motor Survey (Roach and Kephart 1966).

Techniques were used to modify the behavioural patterns of the subjects. The influences of this behaviour modification on perceptual-motor performance was evaluated.

The basic assumption concerning the generalizability of perceptual-motor training to other parameters was investigated. The development of one aspect of body image was the parameter studied. Development of this concept was measured by the Hand, Eye, Ear Test (Head, 1926) and the Personal Orientation Test (Weinstein, 1958).

The methods used will be discussed under the headings: subjects, procedures, and measurements.

SUBJECTS

The subjects for the study were from the Evelyn Unger School for Language and Learning Development (see Appendix I). The children were assumed to having learning disabilities resulting from a variety of possible causes. Eight children were selected from the 5 to 7 year age group. This age group was chosen since the Kephert program is designed for children aged 6 and upwards. Also the study by Ball and Edgar (1966), with which the results were compared, used children of kindergarten age.

The eight subjects were chosen on the basis of their teachers recommendations as having no serious physical deficit and with regular attendance records. Four children were randomly assigned to the experimental group and four to the control group (see table I).

TABLE I

ASSIGNMENT OF SUBJECTS TO GROUPS

Subject	Group	Number
A	E	1
B	C	5
C	E	2
D	C	6
E	E	3
F	C	7
G	E	4
H	C	8

The mean chronological age of the experimental group

was 6 years 5 months, and the mean chronological age of the control group was 5 years 10 months. Three of the eight subjects were girls.

TABLE II

CHRONOLOGICAL AGE AND SEX OF SUBJECTS

Groups	Number M	Number F	Mean C. A.
Experimental	3	1	6 yrs. 5 mths
Control	2	2	5 yrs. 10 mths

The behaviour of the subjects was reported by their class teacher as distractable and frequently inappropriate to the learning situation. The assumption was made that these inappropriate behaviours might be inhibiting the perceptual-motor development of the subjects. It was hypothesized that modification of such behaviour might facilitate further perceptual-motor development.

PROCEDURES

Discussion of the procedures used is divided into pre-training conditions, training conditions, and the training program.

1. Pre-training conditions

All subjects were recorded for behavioural responses

and perceptual-motor performance in the pre-training period. They were also scored on the criterion measures of body image development.

(a) Behaviour recordings - Both the experimental and the control groups were observed and baseline behaviour scores were recorded. These baseline scores consisted of the percentage of appropriate and inappropriate responses in any one recording session. Responses were defined in terms of relevance to the learning situation. Recordings were made on each of three consecutive days. Each subject's behavioural responses were recorded during a half-hour session. Two pocket counters were used to record raw scores, and these were then converted to percentages of appropriate and inappropriate responses. The mean of the three recordings was taken as the baseline behaviour score for each subject (see table III). Test-retest correlations were computed for Day 2 and Day 3 to determine the reliability of these recordings. The reliability was .807 (see Appendix C, table VI).

No reinforcement was given during the baseline recording of behavioural responses.

(b) Perceptual-motor performance

Both the experimental and the control groups were rated on four items from the Purdue Perceptual Motor Survey.

TABLE III

BASELINE BEHAVIOUR RECORDINGS

Subject	DAY 1		DAY 2		DAY 3		MEAN	
	App.*	Inapp.	App.	Inapp.	App.	Inapp.	App.	Inapp.
1	62	38	59	41	59	41	60	40
2	63	37	68	32	70	30	67	33
3	64	36	62	38	66	34	64	36
4	66	34	61	39	65	35	64	36
Exp. G Mean	63.75	36.25	62.5	37.5	65	35	63.75	36.25
5	53	47	59	41	53	47	55	45
6	59	41	57	43	60	40	60	40
7	71	29	75	25	70	30	72	28
8	66	34	65	35	70	30	67	33
Control G. Mean	62.25	37.75	64	36	63.25	36.75	63.5	36.5

*Percentages of appropriate/inappropriate responses

The items chosen were the walking board; imitation of movements; obstacle course; and angels-in-the-snow. The initial ratings for each subject on the Purdue Perceptual Motor Survey are given in table IV.

(c) <u>Generalizability of perceptual-motor training</u> - It was hypothesized that improvements from perceptual-motor training would generalize to other learning parameters. This hypothesis is the assumption underlying most perceptual-motor training programs. The parameter tested was one aspect of the development of body image. The measurement criteria

TABLE IV

INITIAL RATING ON PURDUE PERCEPTUAL MOTOR SURVEY

SUBJECT	SCORE
1	11
2	14
3	17
4	14
EXP. GROUP MEAN	14
5	17
6	
7	20
8	20
CONTROL GROUP MEAN	19

were the Hand, Eye, Ear Test (Head, 1926), and the Personal Orientation Test (Weinstein, 1958). The pre-training scores for each of these tests are given in table V.

TABLE V

PRE-TRAINING SCORES ON MEASURES OF
BODY IMAGE DEVELOPMENT

SUBJECT	HAND, EYE, EAR TEST	PERSONAL ORIENTATION TEST
1	3.5	15
2	4	26
3	4	24
4	3.5	10
EXP. GROUP MEAN	3.75	18.75
5	4	18
6	4	16
7	4.5	18
8	4	21
CONTROL GROUP MEAN	4.125	18.25

2. Training Conditions

The experimental group was given three training conditions. Under each condition subjects in the experimental group were seen every day for a half-hour training session. Varying patterns of reinforcement were followed. Behavioural responses were recorded throughout on pocket-counters. At the end of each of the three experimental conditions, the subjects in the experimental group were tested on four items from the Purdue Perceptual Motor Survey. The purpose was to determine any influence the different reinforcement conditions might have on perceptual-motor performance.

Condition I - During this condition responses to the perceptual-motor activities given were rewarded with positive social reinforcement. Inappropriate responses were ignored. All subjects in the experimental group had mean baseline behaviour scores of less than 68 per cent appropriate responses. It was expected that under conditions of positive reinforcement the number of appropriate responses would increase. The criterion for changing to training Condition II was designated as 80 per cent appropriate response in any given training session. A subject was required to reach this criterion and maintain that behavioural level for two consecutive days before being changed to the second training condition.

Condition II - During training sessions under this condition, positive reinforcement for appropriate responses was replaced

by positive reinforcement for inappropriate responses. It was expected from the literature that appropriate behaviour would decrease and inappropriate behaviour increase until a further changeover of reinforcement was made. The procedures in the second condition were continued until the pattern of appropriate and inappropriate behaviours showed a reversal of the pattern under Condition I.

Condition III - In the third training condition reinforcement for appropriate behavioural responses was reinstated. It was expected that the reinforced behaviour would increase, appropriate behaviours again rising in frequency. It was hypothesized that the percentage of non-reinforced, inappropriate behaviours would fall, as in Condition I. Reinforcement in Condition III was continued until appropriate behaviours reflected the pattern seen under Condition I. This marked the end of the training procedures.

3. Training Program

The investigator worked with each child individually for one half-hour per day, five days a week, for six weeks. The number of training sessions for each child was 30. Each training session comprised of several perceptual-motor activities. Activities were chosen on the basis of those suggested by Kephart (1960) and Chaney and Kephart (1968) as developing body image. In some cases apparatus determined

the body parts to be used. For example, the trampette was limited to feet, seat and knees. Other pieces of equipment allowed a wide variety of movements using many different body parts. Other activities demanded the use of a combination of body parts in creeping, crawling, wriggling, etc. through, over, under, between, behind and around objects.

Care was taken to avoid any procedures directly related to the criterion measures of body image development. This avoided the possibility of training contamination in the testing of body image development. Any naming or pointing to parts of the face were avoided. While working with the subjects the words right and left were not used.

Time was spent with individual members of the control group in their classrooms and outside during recess. It was hoped this would reduce any Hawthorne effect in the post-training tests regarding familiarity with the investigator.

It was assumed that all the subjects, because of their similar abilities and classroom assignments, were involved in equivalent non-research activities.

MEASUREMENT

(a) General Introduction - Both the experimental and control groups were tested before and after the training program on a four-item rating from the Purdue Perceptual Motor Survey

(Roach and Kephart, 1966); on a modified version of Head, Hand, Eye, Ear Test (Head, 1926); and on the Personal Orientation Test (Weinstein, 1958). The Purdue Perceptual Motor Survey rating was made to ascertain whether or not training had been effective at the training (motor) level. The other two tests determined whether any such improvement generalized to other, non-training situations.

Behaviour recordings were made. The effects of behaviour modification on perceptual-motor performance were assessed by rating the experimental group on the Purdue Perceptual Motor Survey after each training condition. All tests were administered by the investigator.

(b) Reliability - Test - retest reliability was computed on all measures using Pearson product-moment correlation. All test-retest computations were based on data from the control group with a 10-week test-retest interval. The exception to this was the reliability calculation for the behaviour recordings where the test-retest interval was one day. Table VI presents a summary of the reliability estimates for the various measures.

(c) Validity - No precise evidence was found to validate the use of the Purdue Perceptual Motor Survey for subjects with learning disabilities. Its use for such subjects was implied in the work of Kephart (1960, 1965); Roach and

TABLE VI

RELIABILITY ESTIMATES FOR ALL MEASURES

Measure	Test - Retest N	r
Purdue P.M. Survey	4	.866
Hand, Eye, Ear Test	4	.773
Personal Orientation	4	.44
Behaviour recordings	4	.807

Kephart (1966); Chaney and Kephart (1968). The original training procedures of Kephart (1960) were designed for the "slow learner". On the basis of these implications the assumption was made that the use of the Purdue Perceptual Motor Survey was appropriate with subjects having learning disabilities.

The Hand, Eye, Ear Test and Personal Orientation Test were incorporated as measures of body image. These tests have been used previously as measures of body image (Ball and Edgar, 1967; Semmes et al., 1963). Maloney (1970) demonstrated their validity for this purpose. He obtained a significant correlation of r = .56, p.001.

(d) The measures

(i) Purdue Perceptual Motor Survey (Roach and Kephart, 1966). This was used to test the first hypothesis that

improved perceptual-motor efficiency will result from a perceptual-motor training program in children with learning disabilities. Ratings on the survey reflected changes in motor skill relevant to training. The Survey is a rating scale which assesses proficiency in a number of perceptual-motor activities. The activities used in this study were:

1. Walking board - forward, backward, sideward.
2. Imitation of movement.
3. Obstacle course.
4. Angels-in-the-snow.

Each activity was administered and scored according to Roach and Kephart (1966).

Reliability for the Purdue Perceptual Motor Survey was .97 in a study with retarded subjects (Maloney, 1970), and a .96 correlation was determined in using the survey with slow learners. Test-retest reliability in this study was .866 using Pearson product-moment correlation (see Appendix C, table III).

(ii) Hand, Eye, Ear Test (Head, 1926) - The modified version of Head's test retained the original 16 items. These were divided into parallel halves and their order independently randomized within each half. Eight of the 16 items involved imitation of ipse-lateral movements, for example touching the right eye with the right hand. The remaining eight involved cross-lateral movements, for example

touching the left ear with the right hand. The item sequence for the modified version is as follows:

1 & 10 - right ear with right hand
2 & 16 - left eye with left hand
3 & 11 - right eye with right hand
4 & 13 - left ear with right hand
5 & 9 - left eye with right hand
6 & 14 - right eye with left hand
7 & 15 - left ear with left hand
8 & 12 - right ear with left hand

The subject, seated opposite the examiner, is asked to imitate the above gestures presented to him in a series of diagrams (see Appendix D). Diagrams were used rather than imitations of the examiner's movements to promote standardization and to decrease training contamination in the testing situation. Verbal concepts of right and left are not required in this test. A normal adult is expected to transpose the examiner's right and left in terms of his own body, but children of the age of the subjects will give a mirror imitation. Since mirror images are developmentally normal for the subjects they were counted as correct. A single transposed response in a series of mirror responses was counted as an error, even though it was technically correct.

Reliability of this test in a study using normal kindergarten children as subjects was .79 (Ball and Edgar, 1967). In a study with retarded subjects reliability was

.80 (Maloney, 1970). Test-retest correlation in this study was .773 (Pearson product-moment correlation, see Appendix C, table IV).

(iii) Personal Orientation Test (Weinstein, 1958). The measure used in this study was a modification (Maloney, 1970) of the original procedure used by Weinstein (1958) and later discussed by Semmes et al. (1963). In this procedure the subject is required to indicate or touch parts of his body which correspond to points indicated on two diagrams which present a semi-schematic front and back view of a man (see Appendix D). Indicating each point on the diagram the examiner asked "Where is this on you?" or "Show me yours." When a subject had difficulty with the concept involved the examiner would demonstrate by pointing to the forehead of the diagram (not a test item) and touching the subject's forehead saying "This is yours." No further demonstration was given.

Using retarded subjects Maloney (1970) obtained a reliability coefficient of .84 for this test. In the present study test-retest reliability was .44 (Pearson product-moment correlation, see Appendix C, table V).

(iv) Behaviour recordings - The frequency of appropriate and inappropriate behaviours was recorded for both groups during three days' baseline recording sessions. Recording was continued for the experimental group throughout the re-

maining training sessions. The raw frequency count was made with the aid of two pocket counters. The raw scores were later converted into percentages. Reliability of these recordings was established by running a Pearson product-moment correlation on the control group data from days 2 and 3 of the baseline recordings. Test-retest reliability was .807 (see Appendix C, table VI).

(e) Statistics - The following statistical analyses were used:

I. Two-way analysis of variance with repeated measure was used for comparison of pre- and post-training results on the Purdue Perceptual Motor Survey, the Hand, Eye, Ear Test and the Personal Orientation Test. Thus this analysis was used to test hypotheses 1 and 4.

II. Analysis of variance for correlated samples was used to determine any significant changes over time with regard to the behaviour recordings and the Purdue Perceptual Motor Survey ratings under different reinforcement conditions. Thus this analysis was used to test hypotheses 2 and 3.

It was decided to use these two types of analysis even though the data was not strictly in the interval scale. The originators of the various tests used and other researchers

in this field had likewise employed parametrical statistical analyses and, for the purposes of comparison, the present investigator chose this method of analysis also.

CHAPTER IV

RESULTS

The results of the study are given in terms of the original hypotheses.

Hypothesis 1

A perceptual-motor training program based on the work of Kephart (1960) will result in improved perceptual-motor learning in children with learning disabilities.

Table I below is an extraction from the full table of results (see Appendix C, table II). It gives the pre- and post-training ratings on the Purdue Perceptual Motor Survey. These results are also expressed graphically in Figure I.

Using two-way analysis of variance with repeated measure a significant interaction was found at the .05 level of confidence ($F = 11.546$ p .019 df 1). This suggests that the training program did have a significant effect (α .05) on the Purdue Perceptual Motor Survey over the training period. This supports the first hypothesis and the results reported by Painter (1966).

Figure I: Post-Training Ratings on the Purdue Perceptual Motor Survey.

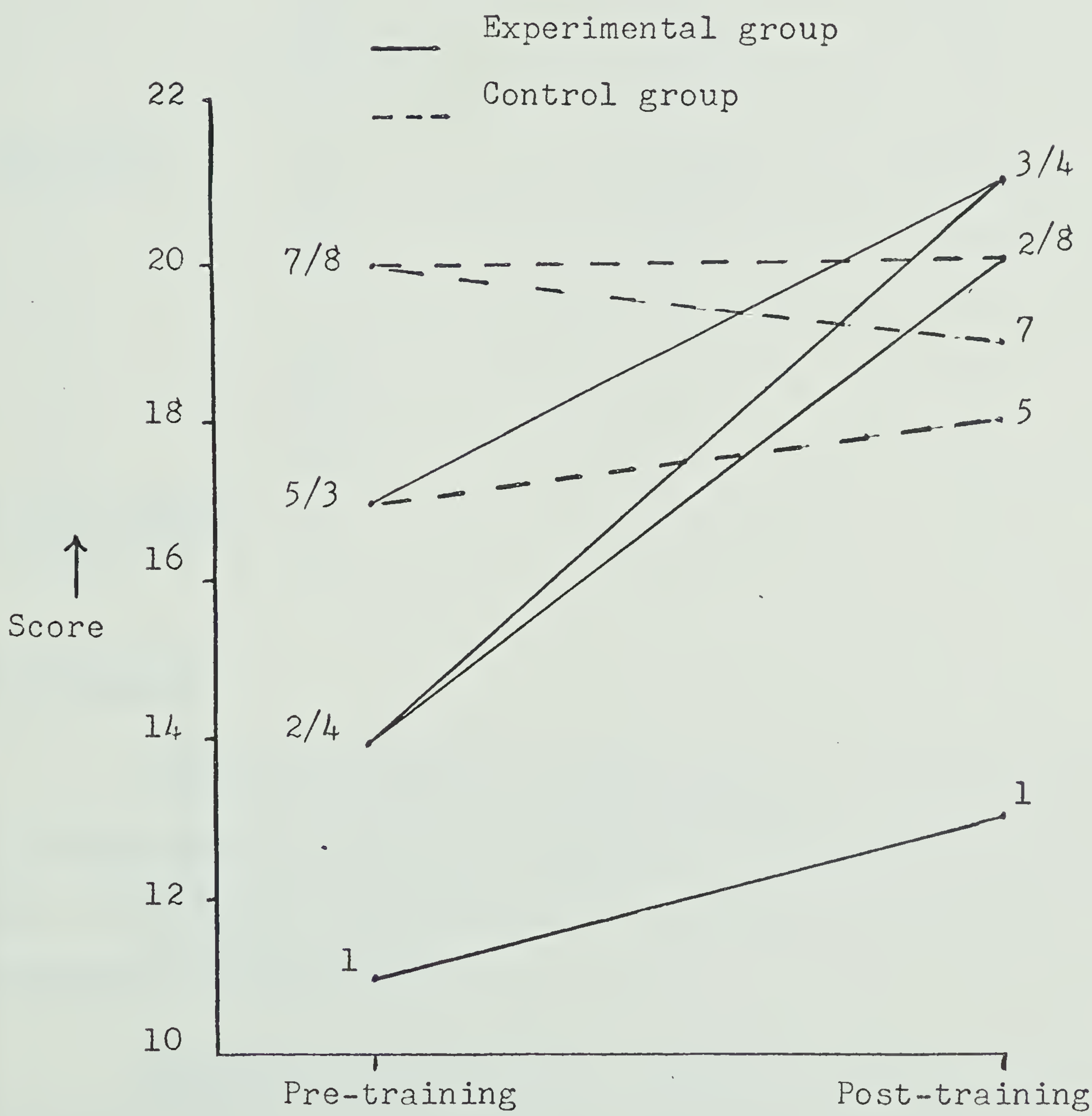


TABLE I

PRE- AND POST-TRAINING RATINGS ON THE PURDUE PERCEPTUAL MOTOR SURVEY

Subject	Pre-training	Post-training	Gain/Loss
1	11	13	+2
2	14	20	+6
3	17	21	+4
4	14	21	+7
Exp. group mean	14	18.75	+4.75
5	17	18	+1
6	-	-	-
7	20	19	-1
8	20	20	0
Control group mean	19	19	0

Hypothesis 2

Changing the pattern of reinforcements will change the behavioural responses of subjects with learning disabilities. Reinforced behaviours will increase and non-reinforced behaviours will decrease.

Behaviour was measured in terms of the occurrence of appropriate and inappropriate behaviours. These two terms were used to designate responses which showed respectively

involvement or non-involvement with the tasks set. Raw counts were made and later converted into percentages. Initial recordings were made on three consecutive days with no reinforcement being given. The mean of these three recordings gave the baseline recordings shown in table II below.

TABLE II

BASELINE BEHAVIOUR RECORDINGS

Subjects	Percentage Responses	
	Appropriate	Inappropriate
1	60	40
2	67	33
3	64	36
4	64	36
Exp. group mean	63.75	36.25
5	55	45
6	60	40
7	72	28
8	67	33
Control group mean	63.5	36.5

The experimental group were then given the perceptual-motor training program. During the program three reinforcement conditions were given. Condition I consisted of reinforcement being given for appropriate behaviours. In

Condition II inappropriate behaviours received reinforcement. Condition III was the reinstatement of reinforcement for appropriate behaviours.

Condition I - The mean percentage of appropriate responses increased from a baseline of 63.75% to 74.3% as shown in table III.

TABLE III

BEHAVIOURAL RECORDINGS AT THE END OF CONDITION I

Subject	Percentage Responses	
	Appropriate	Inappropriate
1	74.4	25.6
2	79.3	20.7
3	64.5	35.5
4	79	21
Exp. group mean	74.3	25.7

The above scores are averaged for each subject over all the training sessions during which reinforcement was given for behaviours involved with the task.

In raw scores subjects 2 and 4 reached over 80% appropriate behaviour. This was the criterion for moving on to the next condition. Subject 1's score of appropriate behaviours increased very gradually. It was thought that she would not reach criterion level for a considerable time, and so was kept in Condition I for the duration of the program.

Subject 3 was different in that his score of appropriate behaviours at first decreased under reinforcement. The review of the literature had not led the investigator to expect this situation. However, subject 3's scores began to rise and it was decided to move him into the next condition even though his score was still below the criterion of 80% appropriate behaviour.

<u>Condition II</u> - The mean percentage of appropriate responses decreased from 74.3% to 69%, while the reinforced inappropriate responses increased from 25.7% to 31%. Table VI shows this change.

These changes were less than might have been expected except for the behaviour of subject 3. In his case the reinforced behaviour decreased and the non-reinforced behaviour increased. The criterion for ending Condition II was that the subjects' behavioural pattern should show a reversal of the pattern seen under Condition I. All three subjects (2, 3, and 4) met this criterion.

<u>Condition III</u> - Under reinstatement of reinforcement for appropriate behaviour a further change occurred. Table V shows that the mean percentage of appropriate behaviours rose from 69% to 80.3%.

Again the behaviour of subject 3 differed from that of the other subjects. At first his reinforced responses decreased, but after two or three training sessions began to

increase gradually.

TABLE IV

BEHAVIOUR RECORDINGS AFTER CONDITION II

Subjects	Percentage Responses Appropriate	Inappropriate
1	-	-
2	65	35
3	80	20
4	62	38
Exp. group mean	69	31

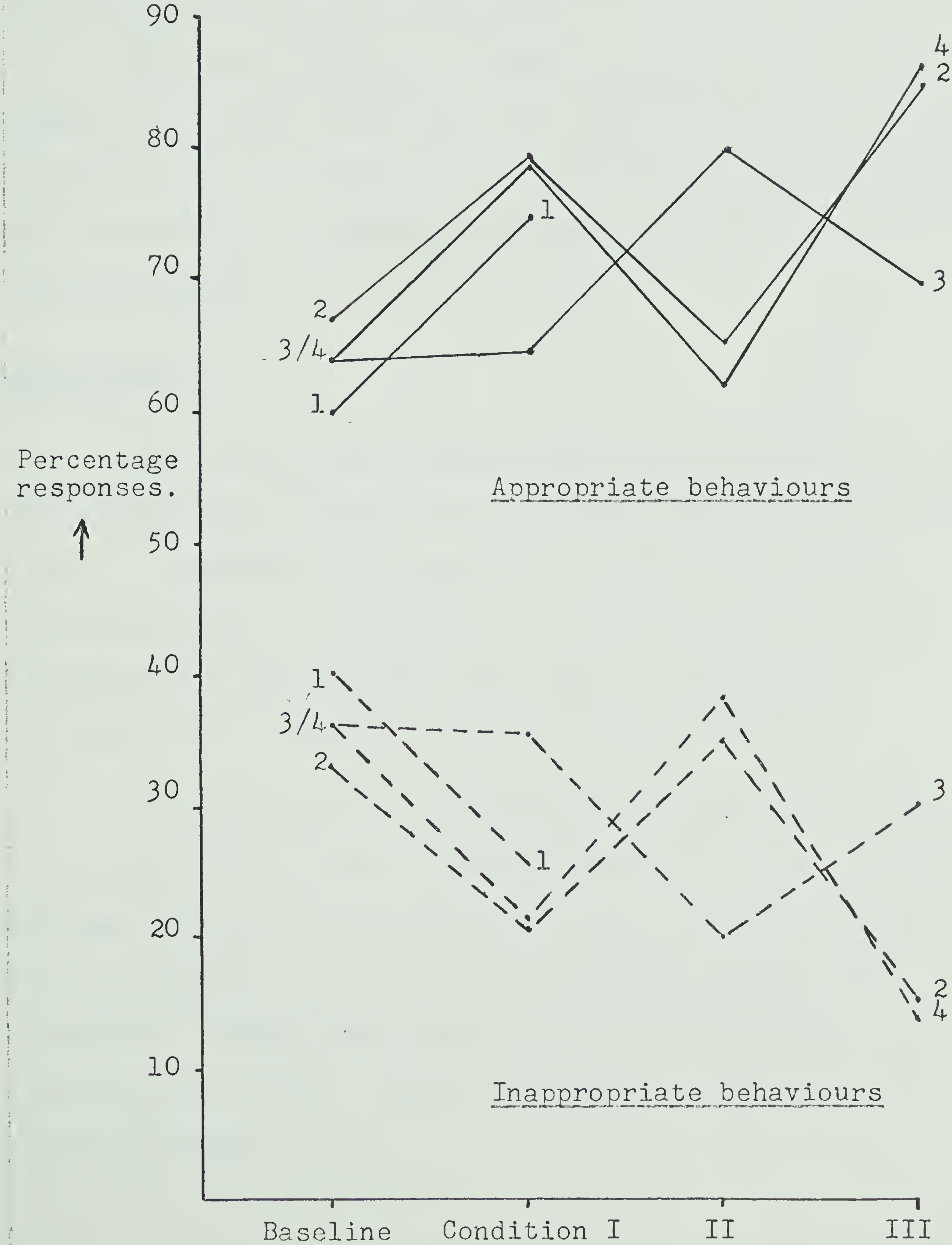
TABLE V

BEHAVIOUR RECORDINGS AFTER CONDITION III

Subjects	Percentage Responses Appropriate	Inappropriate
1	-	-
2	85	15
3	70	30
4	86	14
Exp. group mean	80.3	19.7

The trends seen from these tables and shown graphically in Figure II seem to support the hypothesis that changing the pattern of reinforcement changes the

Figure II: Responses of the Experimental Group under Different Reinforcement Conditions.



pattern of behaviour. Two subjects did show the expected pattern of responses, while the third subject showed a reversal of that pattern. However all three showed changes in response contingent upon changes in reinforcement.

Analysis of variance showed no significant interaction ($F = 1.75 \propto .05$ df 6). The Null hypothesis was not rejected at the .05 level of confidence and it was concluded that there were no significant changes in behaviour over the training period.

Hypothesis 3

(a) Permitting inappropriate behaviours inhibits perceptual-motor performance in children with learning disabilities. Encouraging appropriate behaviour facilitates perceptual-motor performance. (b) Use of reinforcement techniques to increase the occurrence of appropriate behaviour can accelerate perceptual-motor learning.

Perceptual-motor performance was measured in terms of ratings on the Purdue Perceptual Motor Survey. A rating was made for each subject initially and then for subjects in the experimental group at the end of each reinforcement condition. Ratings were given on each of four items out of a total of 24 points. Totals are shown in Table VI and graphed in Figure III.

Figure III: Purdue Perceptual Motor Survey Ratings under Different Reinforcement Conditions.

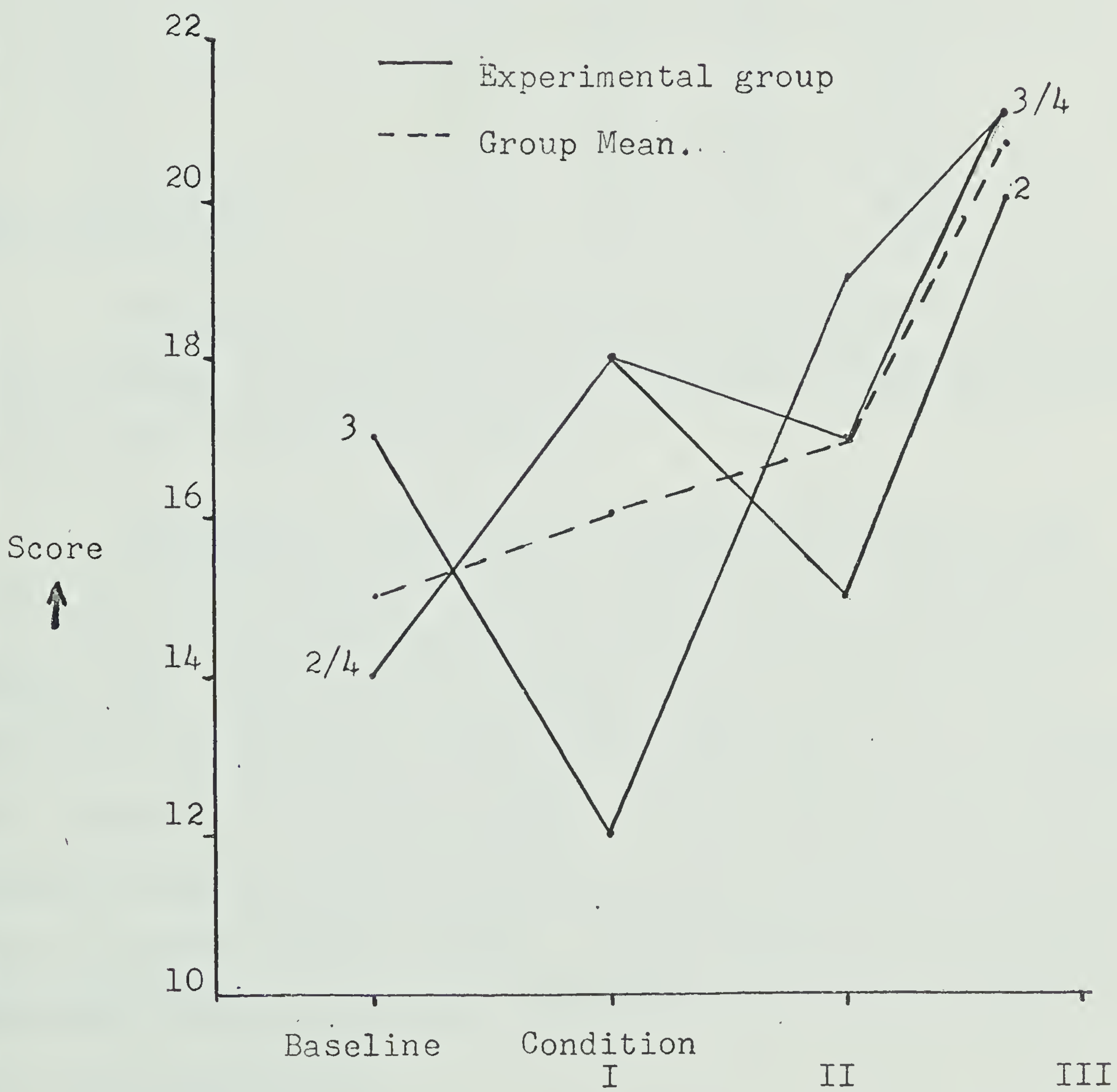


TABLE VI

PURDUE PERCEPTUAL MOTOR SURVEY RATINGS
AFTER EACH REINFORCEMENT CONDITION

Subjects	Ratings			
	B	1	2	3
1	(11)	-	-	(13)
2	14	18	15	20
3	17	12	19	21
4	14	18	17	21
Exp. group mean	15	16	17	20.7

Analysis of variance showed no significant (oc .05 df 6) changes in performance on the Purdue Perceptual Motor Survey over the training period.

Although no significant changes were found at the .05 level of confidence certain trends can be identified, see Figure III. Results from subjects 2 and 4 showed that an increase in reinforced appropriate behaviours was accompanied by a decrease in Purdue ratings. When reinforcement was returned to appropriate behaviours, such behaviours increased and so did the Purdue ratings. Thus results on the Purdue Perceptual Motor Survey for subjects 2 and 4 gave support to the third hypothesis.

When appropriate behaviours were reinforced for

subject 3, their occurrence decreased and the percentage of inappropriate behaviours correspondingly increased. This was accompanied by a decrease in the Purdue Perceptual Motor Survey rating. When inappropriate behaviours were reinforced they decreased and appropriate behaviours increased. This was accompanied by an increase in the Purdue rating. Finally appropriate behaviours were reinforced once more and they began to increase. This was accompanied by an increase in the Purdue rating for subject 3.

The results of subject 3 supported the first part of hypothesis 3. An increase in inappropriate behaviours appeared to inhibit perceptual-motor performance. An increase in appropriate behaviours seemed to facilitate perceptual-motor performance. However it was not until the end of the program that the use of reinforcement began to cause an increase in appropriate behaviours. Prior to that reinforcement had the opposite effect of causing an increase in the non-reinforced behaviour.

Thus the results of subject 3 supported the first part of hypothesis 3 but not the second.

Hypothesis 4

When perceptual-motor development is accelerated in children with learning disabilities there is a concomitant generalized effect to body image development.

Two measures of body image development were used: the Hand, Eye and Ear Test (Head, 1926) and the Personal Orientation Test (Weinstein, 1958). Table VII is an extraction of the full table of results (see Appendix C, table II). It gives the pre- and post-training scores for both the experimental and the control group on the measures of body image development.

TABLE VII

SCORES ON MEASURES OF BODY IMAGE DEVELOPMENT

a) Hand, Eye, Ear Test

Subjects	Pre-test	Post-test	Gain/Loss
1	3.5	7.5	+4
2	4	8	+4
3	4	4	0
4	3.5	8	+4.5
Exp. group mean	3.75	6.875	+3.125
5	4	3.5	- .5
6	4	4	0
7	4.5	5	+ .5
8	4	4.5	+ .5
Control group mean	4.125	4.25	+ .125

Three of the four subjects in the experimental group showed raw score increases of 4 points or more. The fourth

subject showed no change. In the control group one subject showed no change, one showed a decrease of .5 and two showed increases of .5. Overall the experimental group showed an increase of 3.125 while the control group increased by 0.125. These figures are expressed graphically in Figure IV (a).

Two-way analysis of variance with repeated measure found a significant interaction at the .05 level of confidence (F = 7.784 p .032 df 1). This suggests that the effects of the perceptual-motor program did generalize to give an increase in body image development as measured by the Hand, Eye, Ear Test.

TABLE VII

SCORES ON MEASURES OF BODY IMAGE DEVELOPMENT

(b) <u>Personal Orientation Test</u>

Subjects	Pre-test	Post-test	Gain/Loss
1	15	27	+12
2	26	32	+6
3	24	30	+6
4	10	29	+19
Exp. group mean	18.75	29.5	+10.75
5	18	22	+4
6	16	12	-4
7	18	19	+1
8	21	22	+1
Control group mean	18.25	18.75	+ .05

Figure IV (a): Pre- and Post-Training Scores on the Hand, Eye, Ear Test.

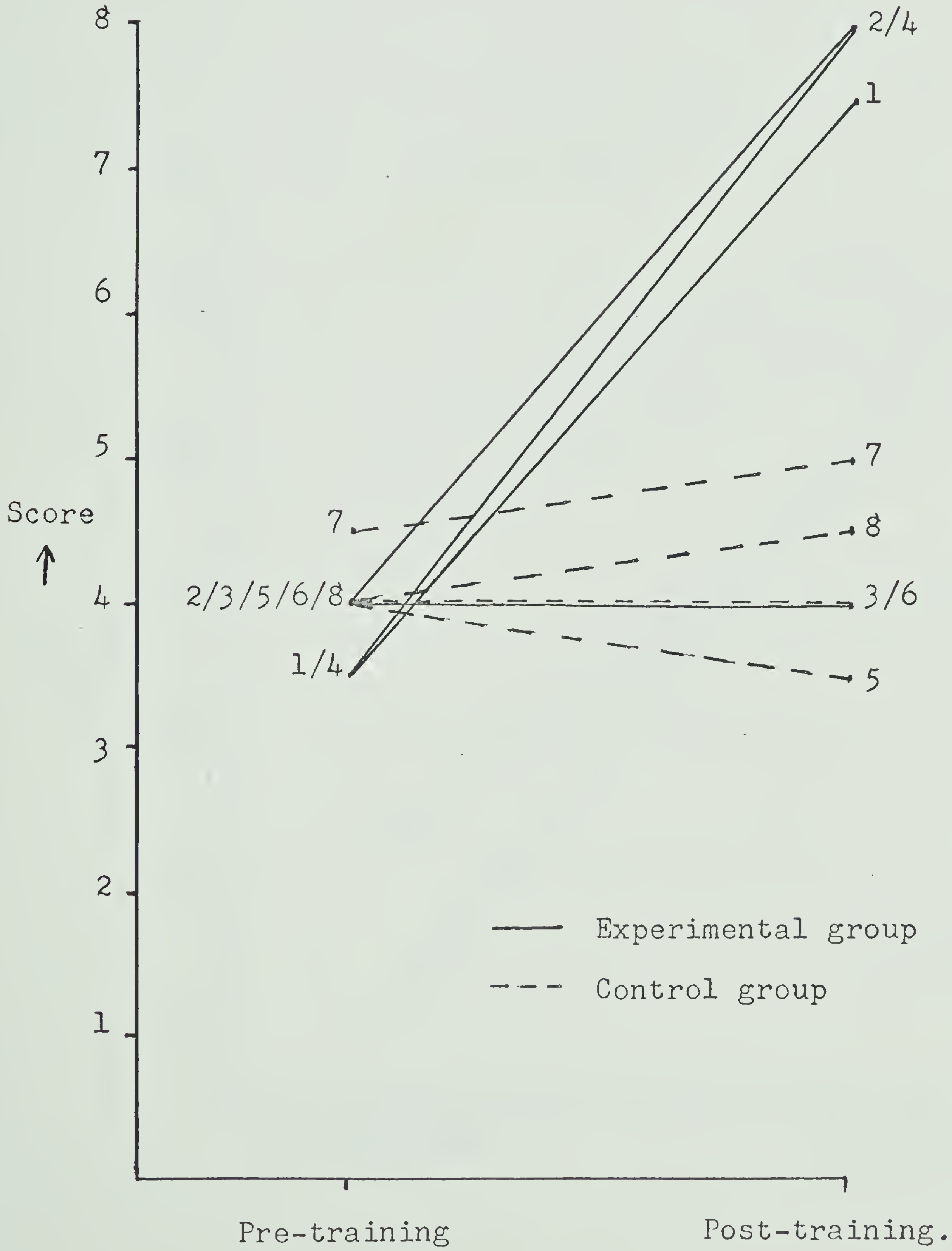
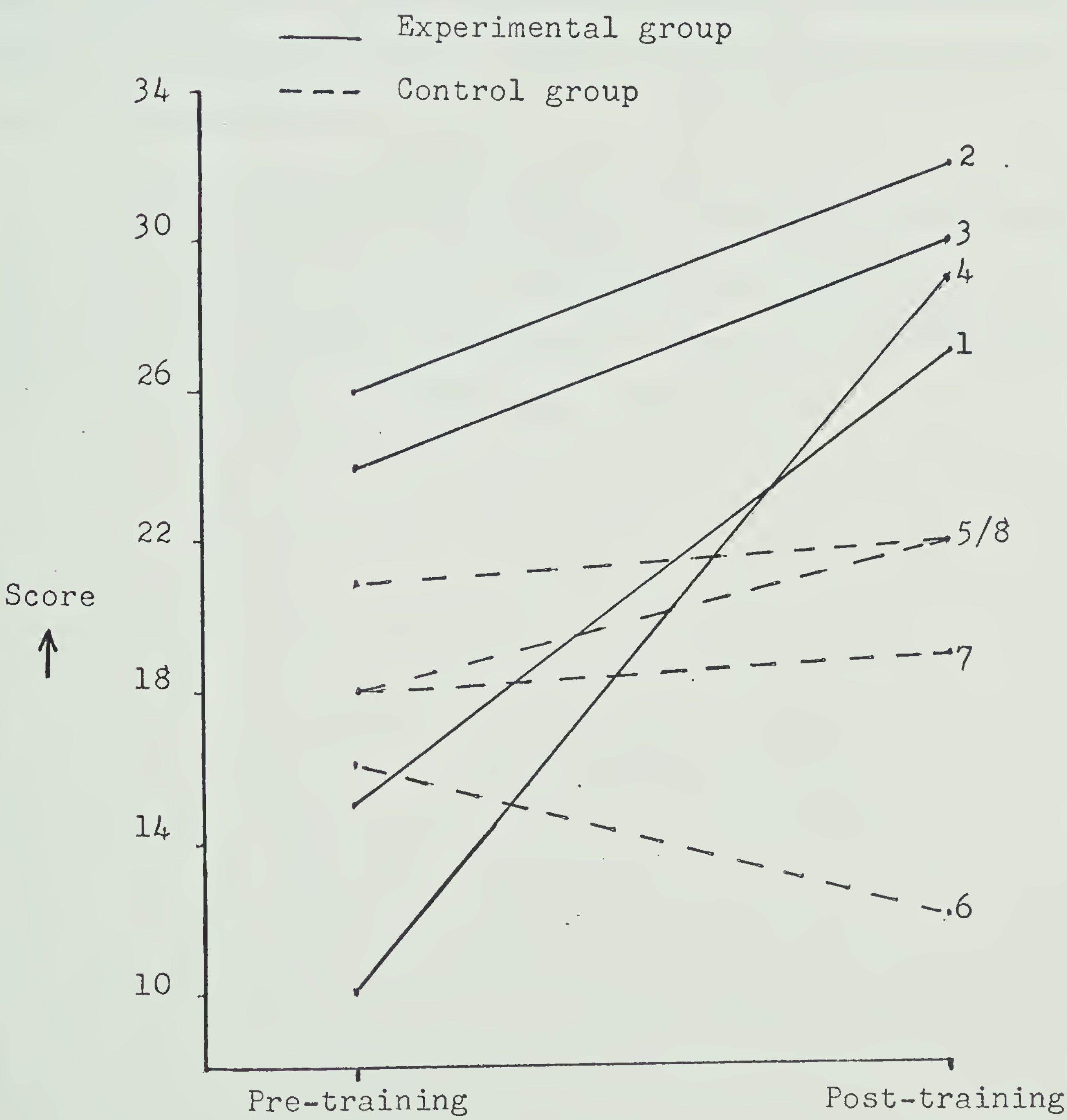


Figure IV (b): Pre- and Post-Training Scores on the Personal Orientation Test.



Two-way analysis of variance with repeated measure found a significant interaction at the .05 level of confidence ($F = 8.533$ p .027 df 1).

Results from the above analysis suggest that the effects of the perceptual-motor program did generalize to give an increase in body image development as measured by the Personal Orientation Test. Figure IV (b) expresses these results graphically.

These results lend support to the fourth hypothesis that when perceptual-motor development is accelerated in children with learning disabilities there is a concomitant generalized effect to body image development.

CHAPTER V

DISCUSSION AND CONCLUSIONS

DISCUSSION

The number of subjects was small and the groups were insufficiently homogeneous to permit a great deal of statistical analysis. Certain inferences can be drawn from the trends depicted in the tables and the graphs and from the statistics that were possible.

Results on the Purdue Perceptual Motor Survey indicated significant ($F = 11.546 \ \alpha \ .05$) improvement in the actual skills due to perceptual-motor training. Evidence of improvement at this stage is necessary before any further statements can be made. The improvement shown by the experimental group on the Purdue Perceptual Motor Survey after training contrasts with the 'no change' found for the control group. This lends support to the original statement that such a program will result in improved perceptual-motor development as indicated by the Purdue Perceptual Motor Survey. Within the limits of this study results showed that children with learning disabilities can improve in perceptual-motor

development when given a perceptual-motor program based on that of Kephart (1960). These findings lend support to the hypothesis of Kephart (1960) and the conclusions of Painter (1966).

The recordings of behavioural responses indicated that the response pattern of the experimental group closely followed the pattern of reinforcements. The behaviour which received reinforcement was the behaviour which increase in frequency of occurrence. The exception to this was the behavioural pattern of subject 3. He displayed almost the antithesis of the results of the other subjects. His behaviour may be partly explained as a result of the type of reinforcement given. The reinforcement was positive and social, for example "Good boy!", "Well done!", "Very good!" etc. From talking with his classroom teacher it appeared that subject 3 is opposed to being anything which at all resembles a "good boy". Hence when this reinforcement was given for a particular behavioural response it may have served to strengthen the opposite responses. As reinforcement continued this opposition or contrariness began to disappear and his behaviour began to approximate that of the other subjects.

In Condition I reinforcement for appropriate behaviours brought about an increase in those behaviours for all subjects. Inappropriate, non-reinforced behaviours decreased.

In Condition II reinforcement had to be transferred from appropriate behaviours to inappropriate behaviours rather than merely withdrawn. This was necessary because there was a possibility that any improvements occurring under the first condition would continue into the second. The subjects may have found the perceptual-motor tasks themselves enjoyable, and so may have been intrinsically motivated to continue practice. To avoid this confounding reinforcement was not withdrawn, rather it was transferred from the appropriate to the inappropriate behaviours. In this way a reversal effect was obtained for the two types of behaviour contingent upon reinforcement.

Under Condition II the reinforced behaviour again increased. This time it was the inappropriate responses. Condition III was the reinstatement of reinforcement for appropriate responses. As in Conditions I and II the reinforced behaviour increased in occurrence and the non-reinforced behaviour decreased in occurrence. The changes in behaviour between conditions were not significant but illustrated the expected trends.

Within the limitations of the design and for the subjects concerned results in this part of the study lend support to the statement that changing the pattern of reinforcements will change the pattern of behavioural responses. These results support the findings of Hart et al. (1964), Allen et al. (1964) and Harris et al. (1964) con-

cerning reinforcement and behaviour.

The third hypothesis concerned the relationship of behaviour and perceptual-motor development. It was hypothesized that results on the Purdue Perceptual Motor Survey would indicate facilitation of perceptual-motor development where behaviour was increasingly appropriate. The ratings on the Purdue Perceptual Motor Survey indicated this to some extent but changes were not of the magnitude of the behavioural changes. Also the results of the Purdue Perceptual Motor Survey under each reinforcement condition were greatly affected by the exceptional results of subject 3. (See Appendix C, table II). This masked the striking relationship between behaviour scores and the Purdue Survey ratings seen in the results of subjects 2 and 4. Their results showed the hypothesized relationship of increased appropriate behaviour and facilitation of perceptual-motor development, with increased inappropriate behaviour inhibiting perceptual-motor development.

None of the results regarding perceptual-motor performance and the different training conditions were significant at the .05 level of confidence. Certain expected trends were found and may have proved significant with a larger number of subjects.

Within the limitations of the study these trends

give some support to the main hypothesis of this research. Modifying behaviour can aid perceptual-motor development in children with learning disabilities. In this study behaviour modification increased the frequency of appropriate responses. Perceptual-motor performance was thereby facilitated, though not significantly. This facilitation was indicated in the improved ratings obtained on the Purdue Perceptual Motor Survey when the percentage of appropriate behaviours was high as a result of reinforcement.

According to Kephart (1960) body image develops as a result of the organism's experience with tactile, visual, kinaesthetic and other sensations. All of these sensations form a unity (body image) which represents the body and its relationship to the environment. This body image becomes the point of origin for all spatial relationships among objects outside the body. Empirical use of this construct has been limited because of lack of appropriate measures and poor definition. Few empirical data are available to add clarification to the construct (Maloney, 1970).

Thus it is necessary to have the construct of body image operationally defined to make it clearer and more manageable. Such a definition involves the relevant experimental operations and so is defined in the present study by the content of the tests used to measure it. Based on the Hand, Eye, Ear Test and the Personal Orientation Test, body

image is defined as the ability to indicate either eye or ear cross-laterally and unilaterally, and the ability to indicate points on the front and back aspects of the body.

Results for the Hand, Eye, Ear Test showed a significant ($F = 7.784$ p .032 df 1) gain over the training period at the .05 level of confidence. Results for the Personal Orientation Test also showed a significant ($F = 8.533$ p .027 df 1) gain over the training period at the .05 level of confidence.

The results of the Hand, Eye, Ear Test and the Personal Orientation Test suggest within the limits of this study that when perceptual-motor development is accelerated in children with learning disabilities there is a concomitant generalized effect to body image development. This lends support to the claim (Ball and Edgar, 1966; Maloney et al. 1970) that generalization occurs from perceptual-motor training to body image development.

CONCLUSIONS

Within the limitations of this study and for the type of subject used, the following trends were apparent:

1. A perceptual-motor training program based on the work of Kephart (1960) will result in improved perceptual-motor development in children with learning disabilities. Perceptual-motor development is indicated by ratings on the Purdue

Perceptual Motor Survey.

2. Changing the pattern of reinforcements will change the pattern of behavioural responses in subjects with learning disabilities. Reinforced behaviour will increase, and non-reinforced behaviour will decrease.

3. Permitting inappropriate behaviours in children with learning disabilities inhibits perceptual-motor development. Encouraging appropriate behaviour by giving positive reinforcement facilitates perceptual-motor development. The results of one subject did not support this hypothesis.

4. Results on the Hand, Eye, Ear Test and the Personal Orientation Test supported the suggestion that when perceptual-motor development is accelerated in children with learning disabilities, there is a concomitant generalized effect to body image development.

RECOMMENDATIONS

As a result of the information gained in this study, the following recommendations are made.

1. Further research is recommended to verify these results statistically with larger, homogeneous groups of subjects.

2. Further studies should attempt to determine the effects of behaviour modification on other aspects of motor learning.

3. Further studies should attempt to determine the extent of the generalizability of Kephart's program on other parameters.

4. If evidence of generalizability is found, tests for retention should be given at some date after the training program has ceased.

5. Further study should involve more trained personnel so that there might be a separate program administrator, recorder and examiner. Ideally the examiner should be unfamiliar with the subjects' experimental or control group status.

REFERENCES

Allen, K. E., Hart, B., Buell, J. S., Harris, F. R. and Wolf, M. M. "Effects of social reinforcement on isolate behaviour of a nursery school child". Child develpm., 35, 511-8, 1964.

Ball, T. S. and Edgar, C. L. "Perceptual training of retardates with basic body image deficit". California Mental Health Research Digest, 1,21-2, 1963.

Ball, T. S. and Edgar, C. L. "The effectiveness of sensory-motor training in promoting generalized body image development". J. of Special Education, 1, 387, 1966-7.

Baumeister, A. A. Mental Retardation, Aldine Pub. Co., Chicago, 1967.

Bijou, S. W. "Patterns of reinforcement and resistance to extinction in young children". Child develpm., 28, 47-54, 1957.

Bijou, S. W. and Baer, D. Child Development, Vol. 1, Appleton-Century-Crofts, New York, 1961.

Broden, M., Hall, R. V., Dunlap A. and Clark, R. "Effects of teacher attention and a token reinforcement system in a junior high school special education class". Exceptional Children, 36, 5, 341-9, 1970.

Chaney, C. M. and Kephart, N. C. Motoric Aids to perceptual training. Charles E. Merrill, Columbus, Ohio, 1968.

Deese, J. and Hulse, S. H. The psychology of learning. McGraw-Hill Book Co., New York, 1967.

Delacato, C. H. The treatment and prevention of learning and reading problems. Charles C. Thomas, Illinois, 1959.

Ferster, C. B. and Skinner, B. F. Schedules of reinforcement. Appleton-Century-Crofts, New York, 1957.

Festinger, L. A theory of cognitive dissonance. Row, Peterson, Illinois, 1957.

Frostig, M. and Horne, D. An approach to the treatment of children with learning disorders. In: Learning Disorders Vol. I. (Ed.) J. Hellmuth, Special Child Publications, Seattle, 1965.

Getman, G. N., Kane, R. R., Halgren, M. R. and McKee, G. G. The psychology of reading programs. Lyons and Carnahan, Chicago, 1966.

Harlow, H. "Mice, monkeys, men and motives". Psychological Review, 60, 23-32, 1953.

Harris, F. R., Johnston, M. K., Kelly, C. S. and Wolf, M. M. "Effects of positive social reinforcement on regressed crawling of a nursery school child". J. Ed. Psychol., 55, 1, 35-41, 1964.

Hart, B. M., Allen, K. E., Buell, J. S., Harris, F. R. and Wolf, M. M. "Effects of social reinforcement on operant crying". J. exp. Child Psychol., 1, 145-53, 1964.

Held, R. "Plasticity in sensory motor systems". Scientific American, 213, 5, 84-97, 1965.

Hewett, F. "A hierarchy of educational tasks for children with learning disorders". Exceptional Children, 31, 207-14, 1965.

Hilgard, E. R. and Bower, G. H. Theories of Learning. Appleton-Century-Crofts, New York, 1966.

Hilgard, E. R. and Marquis, D. G. Conditioning and learning. Appleton-Century Company, New York, 1940.

Keller, F. S. and Schoenfeld, W. N. Principles of psychology. Appleton-Century-Crofts, New York, 1950.

Kephart, N. C. The slow learner in the classroom. Charles E. Merrill Books Inc., Columbus, Ohio, 1960.

Kephart, N. C. The brain-injured child in the classroom. National Society for Crippled Children and Adults, Chicago, 1963.

Kephart, N. C. "Perceptual-motor aspects of learning disabilities". Except. Child., 31, 201-6, 1964.

Lovitt, T. C. "Operant conditioning techniques for children with learning difficulties". J. of Special Ed., 2, 283-9, 1968.

Maloney, M. P., Ball, T. S. and Edgar, C. L. "Analysis of the generalizability of sensory-motor training". Amer. J. Mental Deficiency, 74, 1970.

Myklebust, H. R. "Lanugage disorders in children". Except. Child, 22, 2, 163-6, 1956.

Painter, G. "The effect of a rhythmic and sensory-motor activity program on perceptual-motor spatial abilities of kindergarten children". Except. Child., 33, 113-6, 1966.

Piaget, J. The origins of intelligence in children. Routledge and Paul, London, 1953.

Roach, E. G. and Kephart, N. C. The Purdue Perceptual Motor Survey. Charles E. Merrill Books Inc., Columbus, Ohio, 1966.

Semmes, J., Weinstein, S., Ghent, L. and Teuber, H. L. "Correlates of imapired orientation". Brain, 86, 747-72, 1963.

Skinner, B. F. The behaviour of organisms. Appleton-Century-Crofts, New York, 1938.

Zaporozhets, A. V. The development of perception in the pre-school child. In: P. H. Mussen (Ed) European research in cognitive development. Monog. Soc. Res. Child. Develp., 30, 2, 100, 82-101, 1965.

BIBLIOGRAPHY

Alley, G. R. and Carr, D. L. "Effects of systematic sensory-motor training on sensory-motor, visual perception, and concept-formation performance of mentally retarded children". Perceptual and Motor Skills, 27, 451-6, 1968.

Bateman, B. Learning disabilities - yesterday, today and tomorrow. In: E. C. Frierson and W. B. Barbe (Eds.). Educating children with learning disabilities. Appleton-Century-Crofts, New York, 1967, p. 10-25.

Becker, W. C., Madsen, C. H., Arnold, C. R. and Thomas, D. R. "The contingent use of teacher attention and praise in reducing classroom behaviour problems". J. of Special Ed., 1, 3, 287, 1966-7.

Birnbrauer, J. S., Wolf, M. M., Kidder, J. D. and Tague, E. "Classroom behaviour of retarded pupils with token reinforcement". J. exp. Child. Psychol., 2, 219-35, 1965.

Campanelli, P. A. "Sustained attention in brain-damaged children". Exceptional Children, 36, 5, 317-23, 1970.

Cratty, B. J. Movement behaviour and motor learning. Lea and Febiger, Philadelphia, 1967 (a).

Cratty, B. J. Developmental sequences of perceptual-motor tasks. Educational Activities Inc., Freeport, L. I., 1967 (b).

Department of Education and Science and the Central Office of Information. Physical education in the primary school. Part I. Moving and growing. H.M.S.O., London, 1967.

Ebersole, M., Kephart, N. C. and Ebersole, J. B. Steps to achievement for the slow learner. Charles E. Merrill Books, Inc., Columbus, Ohio, 1968.

Edgar, C. L., Ball, T. S., McIntyre, R. B. and Shotwell, A. M. "Effects of sensory-motor training on adaptive behaviour". Amer. J. Ment. Deficiency, 73, 713-20, 1969.

Espenschade, A. S. and Eckert, H. M. Motor development. Charles E. Merrill Books Inc., Columbus, Ohio, 1967.

Gesell, A. L. and Amatruda, C. S. Developmental diagnosis. Hoeber, New York, 1947.

Guilford, J. A. "A system of psychomotor abilities". Amer. J. of Psychol., 71, 164-74, 1958.

Harlow, H. "The formation of learning sets". Psychol. Review, 56, 51-65, 1949.

Harris, T. L. and Schwahn, W. E. The learning process. Oxford University Press, New York, 1961.

Head, H. Aphasia and kindred disorders of speech. Vol. I, Cambridge University Press, 1926.

Hebb, D. O. Organization of behaviour: a neuro-psychological theory. Wiley, New York, 1949.

Held, R. and Freedman, S. "Plasticity in human sensory-motor control". Science, 142, 455-63, 1963.

Honig, W. K. Operant behaviour: areas of research and applications. Appleton-Century-Crofts, New York, 1966.

Johnson, D. J. and Myklebust, H. R. Learning Disabilities. Grune and Stratton, New York, 1967.

Johnston, M. K., Kelly, C. S., Harris, F. R. and Wolf, M. M. "An application of reinforcement principles to development of motor skills of a young child". Child Develpm., 37, 379-87, 1966.

Johnston, M. K. and Harris, F. R. Observation and recording of verbal behaviour in remedial speech work. 1965.

Kimble, G. A. Categories of learning and the problem of definition. In: A. W. Melton, Categories of human learning. Academic Press, New York, 1964.

Lunzer, E. A. Recent studies in Britain based on the work of Jean Piaget. National Foundation for Education Research in England and Wales. Occasional Publication No. 4.

Oxendine, J. B. Psychology of motor learning. Appleton-Century-Crofts, New York, 1968.

Piaget, J. and Inhelder, B. The child's conception of space. Routledge and Paul, London, 1956.

Siegel, A. "A motor hypothesis of perceptual development". Amer. J. of Psychol., 66, 301-4, 1953.

Skinner, B. F. Science and human behaviour. Macmillan, New York, 1953.

Smith, R. M. Clinical teaching: methods of instruction for the retarded. McGraw-Hill Inc., New York, 1968.

Strauss, A. A. and Kephart, N. C. Psychopathology and education of the brain-injured child. Vol. II. Grune and Stratton, New York, 1955.

Strauss, A. A. and Lehtinen, L. A. Psychopathology and education of the brain-injured child. Vol. I. Grune and Stratton, New York, 1947.

Thorndike, E. L. Human learning. M.I.T. Press, Cambridge, Mass., 1966.

Van Witsen, B. Perceptual-training activities handbook. T. C. Series in Special Education, Teachers' College Press, Columbia University, New York, 1967.

Zimmerman, E. H. and Zimmerman, J. "The alteration of behaviour in a special classroom situation". J. of exp. Analysis of Behaviour, 5, 59-60, 1962.

APPENDICES

APPENDIX A

THE EVELYN UNGER SCHOOL FOR LANGUAGE AND LEARNING DEVELOPMENT

The Evelyn Unger School for Language and Learning Development

(Formerly Edmonton Aphasic School)

The Evelyn Unger School for Language and Learning Development is owned and operated by the Language and Learning Development Association of Edmonton. It provides highly specialized pre-school and primary teaching level for children who, though not mentally retarded, suffer from brain malfunctions which handicap their normal learning and language abilities.

It is the purpose and objective of the school to overcome these disabilities in order that the pupils may integrate within the regular school systems. Through its volunteer Management Committee and Educational Advisory Committee, it works in close co-operation with the Edmonton Public and Separate School Boards and the Department of Education.

Type of child served

The Evelyn Unger School for Language and Learning Development is interested in serving the child who has auditory and/or visual language difficulty either in speech, reading or writing, etc. Speech is language: language is reading and writing. Therefore we are interested in the child

who has a language and/or learning disability, but is of average, above average, or of near average intelligence. This is known as an auditory and-or visual difficulty. It is often found that when a child has one of these problems it is usually accompanied by the other to some degree.

The child who has an auditory and/or visual difficulty exhibits behaviour of a hyperactive, impulsive nature, or becomes completely withdrawn from his surroundings. He is easily frustrated, distractible, disorganized, repetitive, with a very short attention span, etc. He will not perceive the things he sees, hears or feels, in a proper fashion, the sight or sound becoming distorted when it reaches the brain. Therefore, he cannot learn in a normal educational setting until he is trained to perceive normally.

The incidence of the handicap in the general population is extremely high, at least 5% - 25% of the population representing the largest incidence of handicap or exceptionality in the population. This handicap responds well to rehabilitation, so that the child can, in most cases, compete with his peers.

The Evelyn Unger School for Language and Learning Development, in its own attractive, renovated building, has a Director, seven teachers, two speech therapists, one speech assistant, teaching assistants and a secretarial staff to handle the preparation of curricula materials, etc.

It can now provide for an enrollment of sixty pupils. Between September 1965 and September 1970, 56 pupils integrated into regular school systems. Four other students were transferred to other private schools who could serve them more adequately for their needs.

Each pre-school child is assessed in the facilities of the Glenrose School Hospital, and the school's own language laboratories. Those of school age are assessed in the Educational Clinics of the Edmonton Public and Separate school programs, or by the Educational Psychologists of smaller school districts such as St. Albert and Sherwood Park. If other information is required, such as neurological assessment, hearing evaluation, etc., this is requested.

Classes at the School are limited in number to afford maximum teaching, and special attention offered to group and individual pupil. Language development is supported by private sessions with the speech therapists. To accent this area other devices are used such as Language Masters, Auditory Units, Peabody Language Development Kit, tape recorders, record players, etc.

A specially equipped gymnasium is used to help develop spacial orientation and movement skills.

Published by:
The Evelyn Unger School for Language and Learning Development.
(Extract: 1970).

APPENDIX B

CASE PROFILES OF SUBJECTS

Case Profiles

Subject 1 (Experimental group)

Female, born 25-1-62.
Very limited language development.
Possible brain injury at birth.
Peabody score 48-58.
Bronchial asthma at six months.
Tonsilectonomy at three years.

Subject 2 (Experimental group)

Male, born 2-8-64.
Specific mild EEG abnormalities (suspicion of motor aphasia due to a defect in the parieto-temporal area).
Auditory imperception (receptive aphasia).
Hearing loss severe in right ear (wears aid), mild in left.
Delayed speech development reactive to situational stress.
Chicken pox 1967.

Subject 3 (Experimental group)

Male, born 20-12-63.
Physically normal, left handed.
Hyperactive - vallium drugs, 5 mg.
Immature visual perception due to neurological impairment.
Epilepsy, focal left parietal region.
Slow speech and abnormal behaviour.
Croup 1964; measles 1967; brain injury 1968.
Parents separated, lives with mother.

Subject 4 (Experimental group)

Male, born 19-2-65.
Moderate dyslalia (articulation defect), mildly delayed speech, and language development.
Comprehension and expression good.

<u>Subject 5</u> (Control group)

Female, born 24-8-64.
Moderate to severe bi-lateral hearing loss.
Mother had rubella in 8th week of pregnancy.
Congenital heart disease (secondary to rubella syndrome).
Duplicated renal pelvis of kidneys causing recurrent urinary tract infections.
Catherised at three months and three years.

<u>Subject 6</u> (Control group)

Male, born 2-2-66.
Articulation and speech within norms for his age.
Hyperactive and difficult to handle.

<u>Subject 7</u> (Control group)

Male, born 18-8-63.
Language disorder.
Directionality and auditory reception problems.
Slight epileptic strokes.
Peabody scores CA 6 years and 5 months, MA 2 years and 8 months.
Tongue tie operation 1965.
Nose injury (unconscious) 1966.
Chicken pox 1967.

<u>Subject 8</u> (Control group)

Female, born 25-2-64.
Cleft palate (bifid uvula, submucous cleft and notched hard palate) - nasal sounding speech.
High frequency sensorinoural hearing loss.
Much gastro-enteritis as a baby.
Catherised 3 months and 3 years.
Mother had rubella early in pregnancy.

APPENDIX C

TABLES

TABLE I

BEHAVIOUR RECORDINGS UNDER DIFFERENT TRAINING CONDITIONS

Subjects	Training Conditions							
	B		1		2		3	
	App.	Inapp.	App.	Inapp.	App.	Inapp.	App.	Inapp.
1	60	40	74.4	25.6	*			
2	67	33	79.3	20.7	65	35	85	15
3	64	36	64.5	35.5	80	20	70	30
4	64	36	79	21	62	38	86	14
Mean	63.75	36.25	74.3	25.7	69	31	80.3	19.7

* Subject I did not reach criterion soon enough to justify changing the training condition.

TABLE II

RESULTS ON THE PURDUE PERCEPTUAL MOTOR SURVEY
AND MEASURES OF BODY IMAGE

Subjects	P.O. Pre-test	Head Pre-test	Purdue B	P. 1	P. 2	P. 3	P.O. Post test	Head Post test
1	15	3.5	11			13	27	7.5
2	26	4	14	18	15	20	32	8
3	24	4	17	12	19	21	30	4
4	10	3.5	14	18	17	21	29	8
Mean Exp. Group	18.75	3.75	14	16	17	18.75	29.5	6.875
5	18	4	17			18	22	3.5
6	16	4	*			*	12	4
7	18	4.5	20			19	19	5
8	21	4	20			20	22	4.5
Mean Con. Group	18.25	4.125	19			19	18.75	4.25

* Absent due to illness.

TABLE III

RELIABILITY ESTIMATE FOR THE PURDUE PERCEPTUAL MOTOR SURVEY (Pearson product-moment correlation)

Subject	Control Group	
	Pre-training (X)	Post-training (Y)
5	17	18
6	-	-
7	20	19
8	20	20

$$N = 3$$

$$\Sigma x = 57 \qquad \Sigma y = 57$$

$$(\Sigma x)^2 = 3249 \qquad (\Sigma y)^2 = 3249$$

$$\Sigma x^2 = 1089 \qquad \Sigma y^2 = 1085$$

$$\Sigma xy = 1086$$

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt[2]{\left[N\Sigma x^2 - (\Sigma x)^2\right]\left[N\Sigma y^2 - (\Sigma y)^2\right]}}$$

$$= \frac{3(1086) - (57)(57)}{\sqrt[2]{\left[3(1089) - (57)^2\right]\left[3(1085) - (57)^2\right]}}$$

$$= \frac{9}{\sqrt[2]{108}}$$

$$= \frac{9}{10.39}$$

$$\underline{r = .866}$$

TABLE IV

RELIABILITY ESTIMATE FOR HAND, EYE, EAR TEST
(Pearson product-moment correlation)

Subject	Control Group	
	Pre-test (X)	Post-test (Y)
5	4	3.5
6	4	4
7	4.5	5
8	4	4.5

$$N = 4$$

$$\Sigma x = 16.5 \qquad \Sigma y = 17.0$$

$$(\Sigma x)^2 = 272.25 \qquad (\Sigma y)^2 = 289$$

$$\Sigma x^2 = 68.25 \qquad \Sigma y^2 = 73.5$$

$$\Sigma xy = 70.5$$

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt[2]{\left[N\Sigma x^2 - (\Sigma x)^2\right]\left[N\Sigma y^2 - (\Sigma y)^2\right]}}$$

$$= \frac{4(70.5) - (16.5)(17)}{\sqrt[2]{\left[4(68.25) - 272.25\right]\left[4(73.5) - 289\right]}}$$

$$= \frac{1.5}{\sqrt[2]{3.75}}$$

$$= \frac{1.5}{1.94}$$

$$\underline{r = .773}$$

TABLE V

RELIABILITY ESTIMATE FOR THE PERSONAL ORIENTATION TEST (Pearson product-moment correlation)

Subjects	Control Group	
	Pre-test (X)	Post-test (Y)
5	18	22
6	16	12
7	18	19
8	21	22

$$N = 4$$

$$\Sigma x = 73 \qquad \Sigma y = 75$$

$$(\Sigma x)^2 = 5329 \qquad (\Sigma y)^2 = 5625$$

$$\Sigma x^2 = 1345 \qquad \Sigma y^2 = 1473$$

$$\Sigma xy = 1356$$

$$r = \frac{N\Sigma xy - (\Sigma y)}{\sqrt[2]{\left[N\Sigma x^2 - (\Sigma x)^2\right]\left[N\Sigma y^2 - (\Sigma y)^2\right]}}$$

$$= \frac{4(1356) - (73)\ (75)}{\sqrt[2]{\left[4(1345) - 5329\right] \cdot \left[4(1473) - 5625\right]}}$$

$$= \frac{-51}{\sqrt[2]{13,617}}$$

$$= \frac{-51}{117}$$

$$\underline{r = -.44}$$

TABLE VI

RELIABILITY ESTIMATE FOR BEHAVIOUR RECORDINGS
(Pearson product-moment correlation)

Subject	Control group			
	Day 2		Day 3	
	App. (X)	Inapp.	App. (Y)	Inapp.
5	59	41	53	47
6	57	43	60	40
7	75	25	70	30
8	65	35	70	30

$$N = 4$$

$$\Sigma x = 256 \qquad \Sigma y = 253$$

$$(\Sigma x)^2 = 65{,}536 \qquad (\Sigma y)^2 = 64{,}009$$

$$\Sigma x^2 = 16{,}205 \qquad \Sigma y^2 = 16{,}209$$

$$\Sigma xy = 16{,}347$$

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt[2]{\left[N\Sigma x^2 - (\Sigma x)^2\right]\left[N\Sigma y^2 - (\Sigma y)^2\right]}}$$

$$= \frac{4(16{,}347) - (256)(253)}{\sqrt[2]{\left[4(16{,}205) - (256)^2\right]\left[4(16209) - (253)^2\right]}}$$

$$= \frac{620}{\sqrt[2]{768.2}}$$

$$\underline{r = .807}$$

TABLE VII

TWO-WAY ANALYSIS OF VARIANCE WITH REPEATED MEASURE ON THE PERDUE PERCEPTUAL MOTOR SURVEY PRE- AND POST-TEST RATINGS

For unequal cell members the 'unweighted means' approach is used (Weiner p. 302, 241).

Summary of analysis of variance:

Source of Variation	SS	DF	MS	F	P
Between subjects	86.000	6			
'A' main effects	23.625	1	23.625	1.894	0.227
Subjects within groups	62.375	5	12.475		
Within subjects	53.500	7			
'B' main effects	19.339	1	19.339	11.546	0.019
'A x B' interaction	19.339	1	19.339	11.546	0.019
'B'x subjects within groups	8.375	5	1.675		

Ho $u_1 = u_2$ α .05 df 1

$F_{.05}$ df 1 = $\pm$ 1.61 (from tables)

Reject Null Ho if F < - 1.61 or > 1.61

Since F = 11.546 must reject the Null Ho that $u_1 = u_2$ α .05

Conclude that the training program has a significant effect over time at the .05 level of confidence on the results of the Purdue Perceptual Motor Survey.

TABLE VIII

ANALYSIS OF VARIANCE FOR CORRELATED SAMPLES
(Behaviour recordings for experimental group)

Subjects	Percentage of appropriate behaviours			
	Baseline	Condition I	Condition II	Condition III
1	67	79.3	65	85
2	64	64.5	80	70
3	64	79	62	86

Summary of analysis of variance:

Source of variation	DF	SS	MS	F	
Period SS	3	397.44	132.48	132.48	
Individual SS	2	41.76	20.88		= 1.75
Interaction	6	454.07	75.68	75.68	

Ho $u_1 = u_2 = u_3 = u_4$ α .05 dfs 3,6,
$F_{.05}$ dfs 3,6 = $\pm$ 4.76 (from tables)

Reject Null Ho if F $<$ -4.76 or $>$ 4.76

Since F = 1.75 cannot reject Null Ho that $u_1 = u_2 = u_3 = u_4$
α .05

Conclude that no significant changes in behaviour occurred at the .05 level of confidence over the training period.

TABLE IX

ANALYSIS OF VARIANCE FOR CORRELATED SAMPLES
(Purdue Perceptual Motor Survey ratings for
the experimental group)

Subject	Purdue ratings			
	Baseline	Condition I	Condition II	Condition III
1	-	-	-	-
2	14	18	15	20
3	17	12	19	21
4	14	18	17	21

Summary of analysis of variance:

Source of variation	DF	SS	MS	F	
Period SS	3	55	18.33	18.33	
Individual SS	2	1.17	0.59		= 2.93
Interaction	6	37.5	6.25	6.25	

Ho $u_1 = u_2 = u_3 = u_4$ α .05 dfs 3,6

$F_{.05}$ dfs 3,6 = $\pm$ 4.76 (from tables)

Reject Null Ho if F $<$ -4.76 or $>$ 4.76

Since F = 2.93 cannot reject Null Ho that $u_1 = u_2 = u_3 = u_4$
α .05

Conclude that no significant changes occurred at the .05 level of confidence on the Purdue Perceptual Motor Survey ratings over the training period.

TABLE X

TWO-WAY ANALYSIS OF VARIANCE WITH REPEATED MEASURE ON THE HAND, EYE, EAR TEST

Summary of analysis of variance:

Source of variation	SS	DF	MS	F	P
Between subjects	11.000	7			
'A' main effects	5.062	1	5.062	5.116	0.064
Subjects within groups	5.937	6	0.990		
Within subjects	26.500	8			
'B' main effects	10.562	1	10.562	9.135	0.023
'A*B' interaction	9.000	1	9.000	7.784	0.032
B x subjects within groups	6.937	6	1.156		

Ho $u_1 = u_2$ α .05 df 1

$F_{.05}$ df 1 = $\pm$ 1:61 (from tables)

Reject Null Ho if F $\leq$ -1:61 or $>$ 1:61

Since F = 7.784 must reject Null Ho that $u_1 = u_2$ α .05

Conclude that the training program had an effect significant at the .05 level of confidence on the results of the Hand, Eye, Ear Test.

TABLE XI

TWO-WAY ANALYSIS OF VARIANCE WITH REPEATED MEASURE ON THE PERSONAL ORIENTATION TEST

Summary of analysis of variance:

Source of variation	SS	DF	MS	F	F
Between subjects	315.937	7			
'A' main effects	126.562	1	126.562	4.010	0.092
Subjects within groups	189.375	6	31.563		
Within subjects	305.500	8			
'B' main effects	126.562	1	126.562	10.279	0.019
'A*B' interaction	105.062	1	105.062	8.533	0.027
B x subjects within groups	73.875	6	12.312		

Ho $u_1 = u_2$ $\propto .05$ df 1

$F_{.05 \text{ df } 1} = \pm\ 1\cdot61$ (from tables)

Reject Null Ho if F $< -1\cdot61$ or $> 1\cdot61$

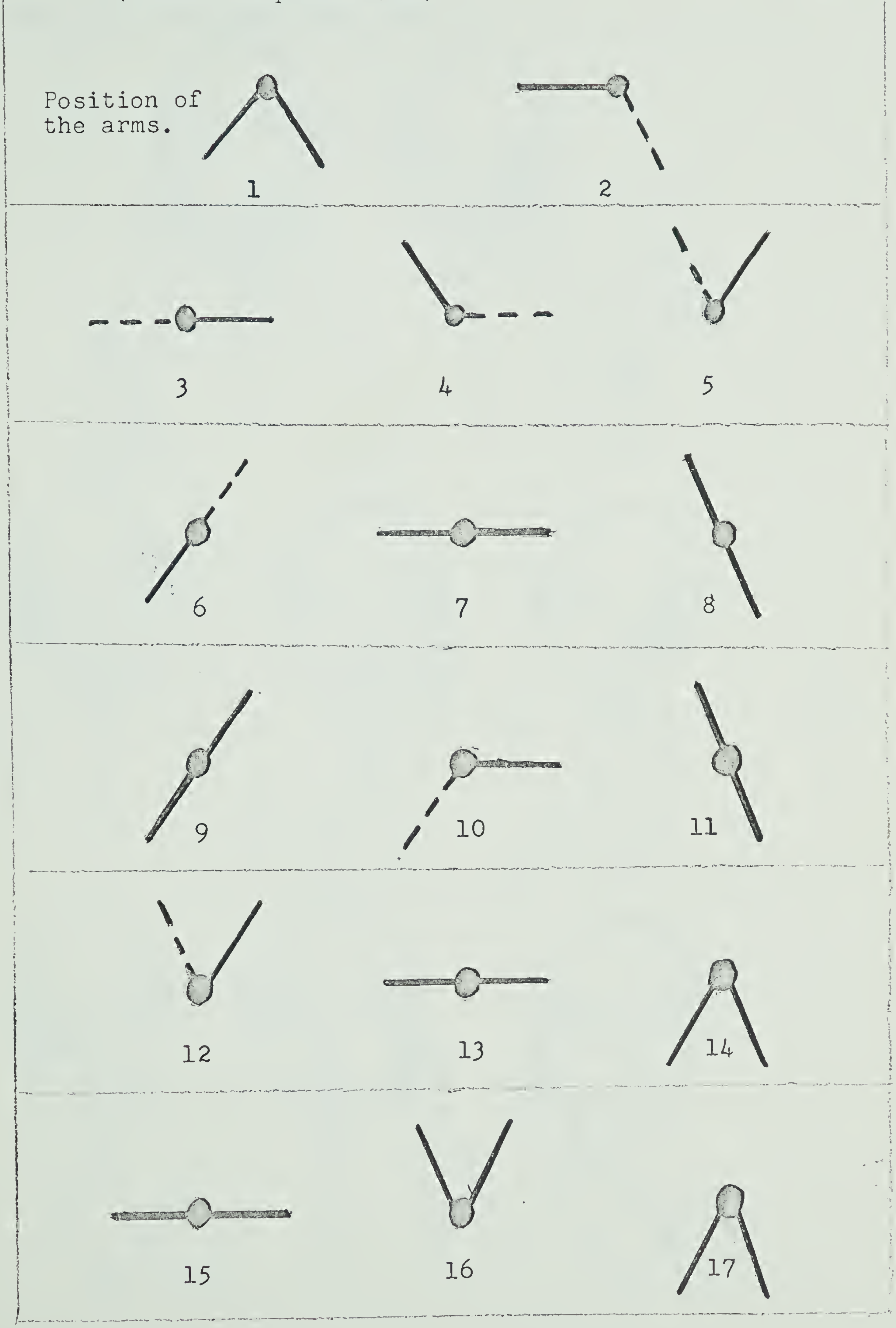
Since F = 8.533 must reject Null Ho that $u_1 = u_2$ $\propto .05$

Conclude that the training program had an effect significant at the .05 level of confidence on the results of the Personal Orientation Test.

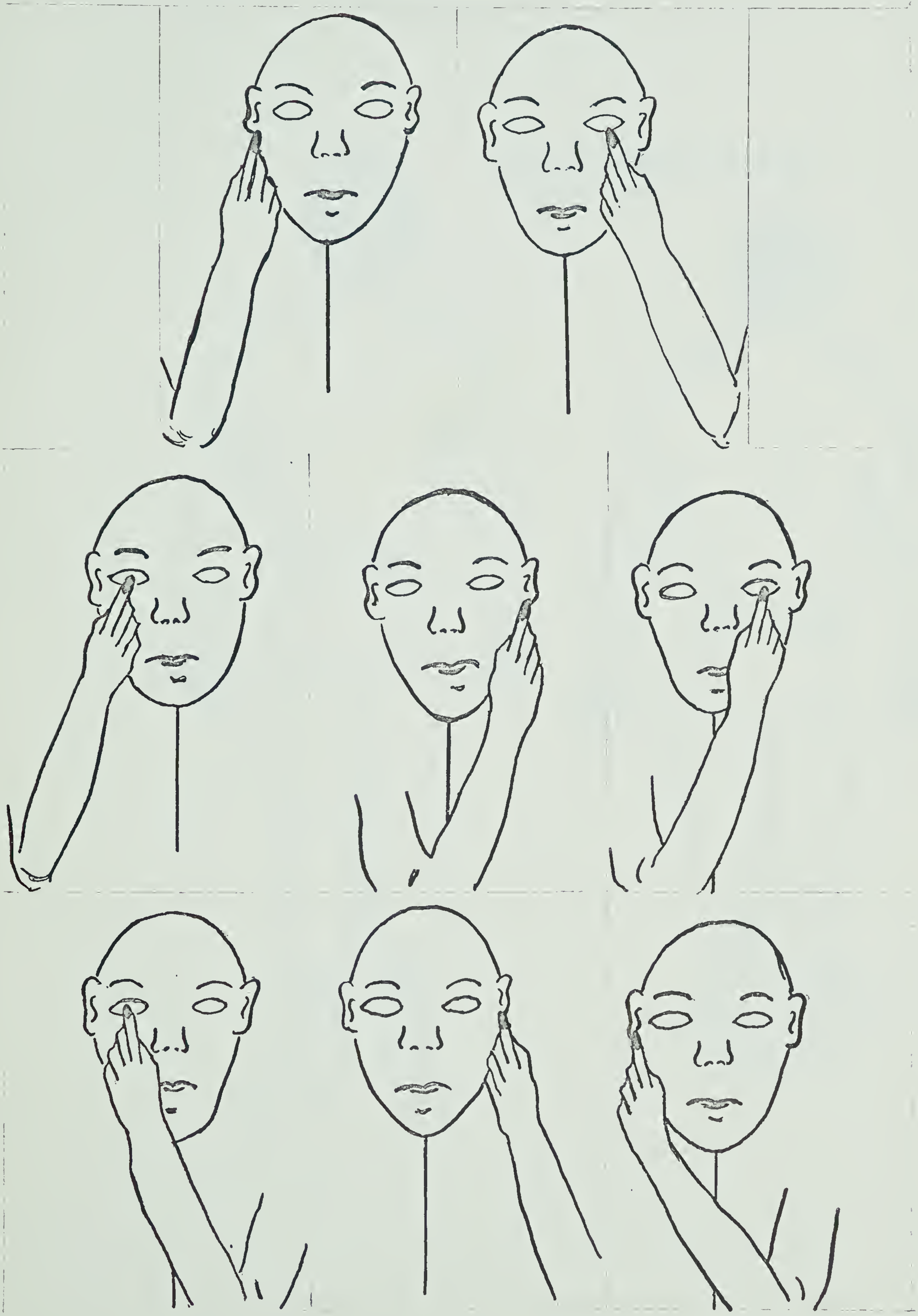
APPENDIX D

TEST CARDS

Purdue Perceptual Motor Survey - Imitation of Movement
(Roach & Kephart 1966)

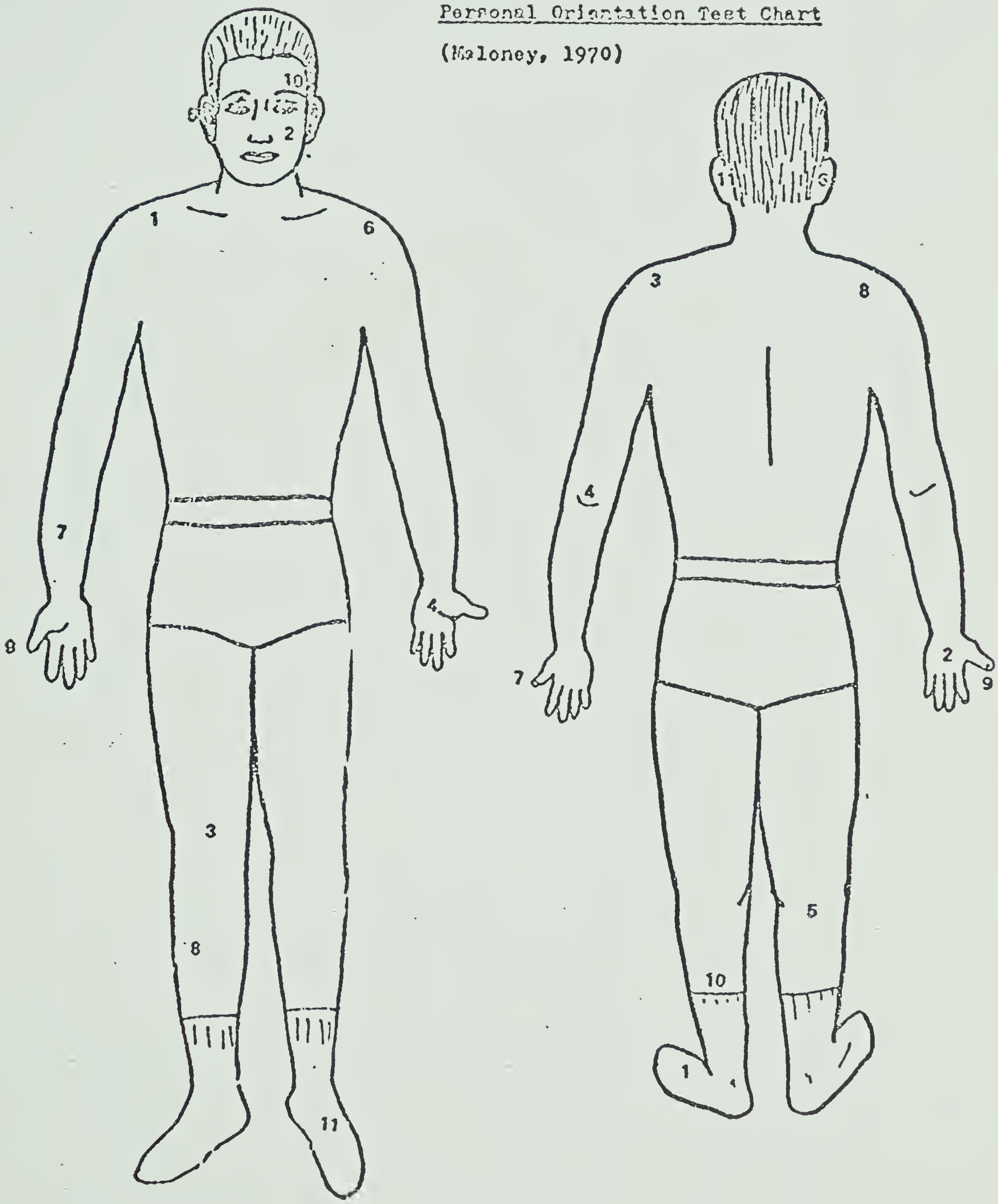


Hand, Eye, Ear Test (Head 1926).



Personal Orientation Test Chart

(Maloney, 1970)



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